MARCH 1982

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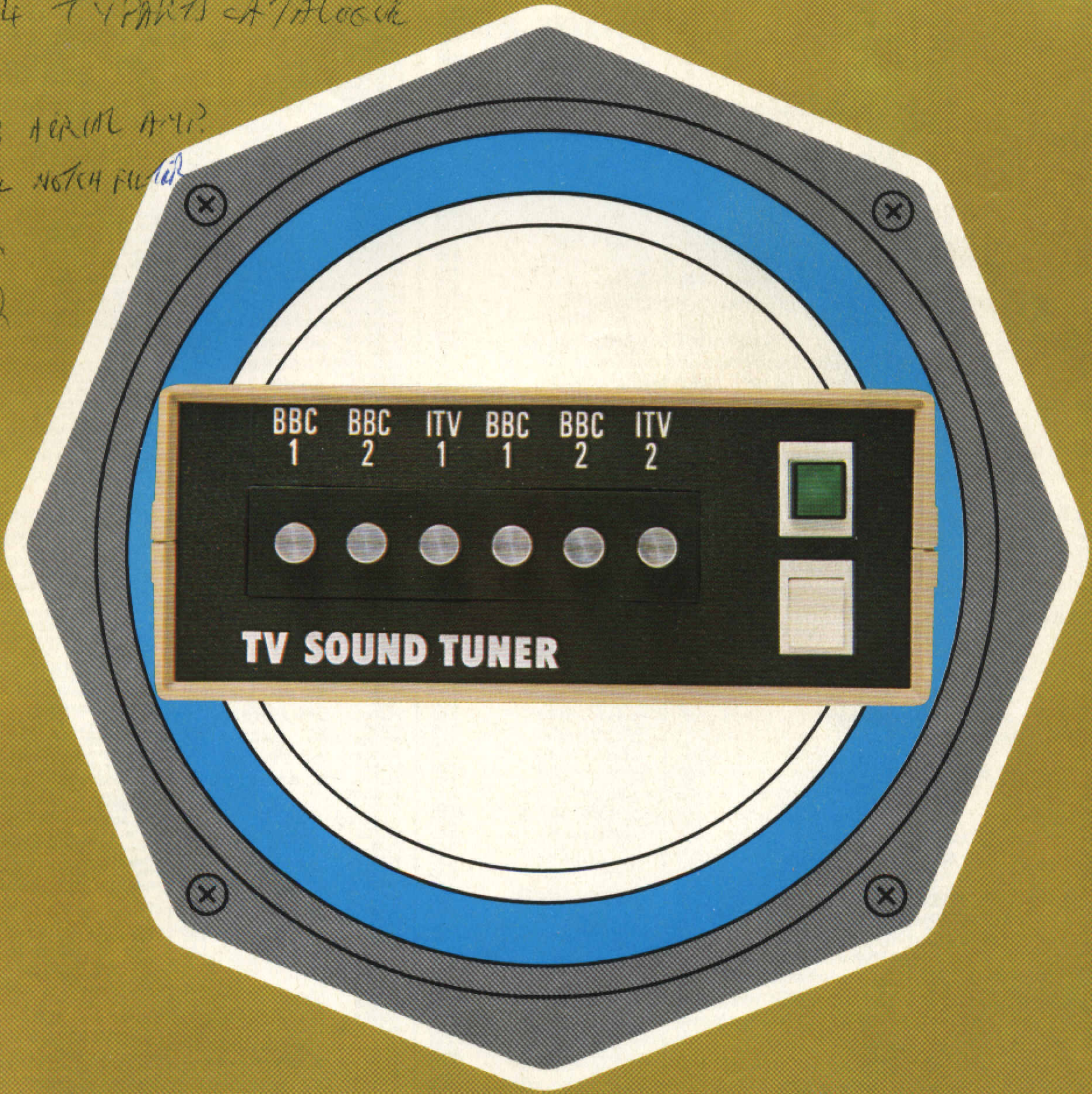

TV SOUND TUNER
FAULT REPORT : VINTAGE TV
VIDEO CAMERA REPORT
TESTING WITH A NEON

TELEVISION

March 1982

Vol. 32, No. 5
Issue 377

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this month

OUR NEXT ISSUE DATED APRIL WILL BE PUBLISHED ON MARCH 17

TELEVISION

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Call for More Engineers

Most readers will be all too well aware of the loss of jobs in the radio/TV field in recent years. Manufacturing activity has decreased since the boom period in the early seventies, while those foreign-owned plants that have been set up in recent times are being operated at much lower manning levels and with the technical back-up required being provided mainly by the parent companies overseas. The job loss in the retail/rental servicing industry over the last five or so years has been even greater. It hasn't received much public attention, since the loss of jobs has been a few here and there rather than the sudden large-scale loss that attracts attention when a major plant closes down. In addition, there's little union activity in the TV servicing field, and TV technicians, being independently minded people by and large, have tended to move off and find alternative employment as best they can elsewhere.

One of the major causes of this job loss in the servicing field has of course been the greatly increased reliability of modern TV sets. The consumer benefits from this, whilst also benefiting from the low prices of our very competitive high street retailers. These low prices mean narrow profit margins however – and a lack of finance with which to provide well stocked and staffed service departments. The lower servicing load resulting from increased reliability has enabled many a shop and rental outlet to operate at a reduced staff level.

The video boom could be the saviour as far as employment in the servicing sector is concerned. Toshiba's assistant managing director Derek Jeffs has recently been lamenting the "shortage of well-trained service engineers for the fast-growing video market, something that will get worse before it gets better." He calls for urgent investment in "recruiting and training engineers capable of servicing video recorders and the other complex electronic products."

The VCR is a reliable product considering its complexity and the price to the consumer, but nevertheless cannot be expected to match the reliability standards now achieved by colour TV sets. A product using sophisticated mechanical as well as electronic techniques will inevitably give more trouble: wear and misalignment of mechanical parts are to be expected, and the scope for misuse is much greater. There is also reason to believe that the need to increase production rapidly to meet the burgeoning demand has led to some increase in VCR failure rate. According to Mr. Jeffs, the VCR service call rate is now almost exactly the same as it was for an earlier generation of colour receivers, at five per cent – in Japan the call-out rate for VCRs has been found to be some ten times that for CTVs.

Will trained service engineers be tempted back into the domestic servicing field? The pay rates that can be offered are unlikely to be much of an inducement unfortunately, while those who've found steady employment in some other branch of electronics, away from the hassle of having to deal with problem customers as well as problem sets, are unlikely to return. There are likely to be opportunities for newcomers to domestic electronics therefore.

An associated problem is training and the availability of adequate technical information. The more complex video equipment becomes – and some of the microprocessor-controlled wonders now on the market could hardly be more complex – the more that's expected of those responsible for training and of the innate abilities of those entering the field. Training is particularly a problem when you are dealing with systems and equipment that originate in foreign lands – or trying to service it for that matter. If something's not clear, you can hardly discuss it in German or Japanese, even if you could afford the phone bill. This is one consequence of our industrial decline: in the early days of television, the development work was carried out locally and those who knew all about it were close at hand and contributed to the technical magazines of the day.

Those who've struggled with inadequate information and confusing drawings, often with a few subtle errors thrown in to test our wits, will know how difficult it can sometimes be to get to the bottom of things. Unfortunately the Japanese don't go in for detailed descriptions of circuit operation, and even when you do come across something you soon realise that the translator had his problems too! Non-technical translators and illustrators can between them make something difficult almost incomprehensible.

Time for stiff upper lips then as we groan under the weight of manuals that nowadays often weigh almost as much as the equipment itself. The fact is that somehow or other all this video equipment is getting serviced, and whilst the more experienced technicians are inevitably having to concentrate on the increasing number of VCRs appearing in their workshops, openings are being created for newcomers to tackle the more routine CTV jobs.

HELD OVER

Once again we've had to hold over several items we'd planned to include in this issue, due this time to shortage of space and the problems we and our contributors have had with post delays and the December snowfalls.

Teletopics

SATELLITE TV RECEPTION

Mullard have introduced a down-converter, type 1100JM, designed as a mast-head unit for the reception of satellite TV signals in the band 11·4-11·7GHz. This band is just below the 11·7-12·5GHz band allocated for satellite TV broadcasting in Europe, but is used by the OTS-2 experimental craft which, in addition to French TV transmissions, is due to start English-language transmissions at approximately 11·6GHz with a beam covering much of Europe and well into Scandinavia to the north. A recent announcement from Satellite TV Ltd. confirms that £4 million has been raised to get this commercial satellite TV channel started (it will then run until the end of the OTS experiment or the failure of the transponder being used).

The Mullard front-end unit is available in two versions, with outputs at 200-400MHz or 0·95-1·45GHz. It contains a low-noise preamplifier using a gallium-arsenide f.e.t., an image-rejection mixer with stable local oscillator, and a u.h.f. preamplifier to bring the signal up to a level suitable for feeding to the downlead. With its wide beam width the OTS signals are at a low level and the Mullard unit is designed for low-level signal processing. The input image rejection is 20dB, the noise figure 4dB maximum and the overall gain 40dB.

The input can be either via a 50Ω SMA coaxial connector or a waveguide flange – the standard practice amongst aerial manufacturers is to use a BDR100 (WG16) flange. Mullard provide a coupling which mates with this flange, tapering to an R140 (WG18) waveguide to attenuate interference below the operational bandwidth. The converter's output is available at an N type socket.

In addition to the 1100JM, Mullard have other converters including one covering the 11·7-12·5GHz range. The output from this is at 0·95-1·75GHz, the 800MHz bandwidth covering the 40 TV channels allocated in the 12GHz broadcast band.

VIDEO DISC LATEST

The stereo sound version of the RCA Selectavision video disc is to be launched in the USA later this year and will feature noise reduction using the CX system, under licence from CBS. This noise reduction system eliminates surface noise and increases the dynamic range by 20dB. The stereo discs will be compatible with the initial non-stereo Selectavision players. RCA have a continuing development programme on their video disc system and recently demonstrated a player that provided still pictures and random access.

Pioneer's version of the LaserVision disc system has been launched in Japan. The initial sales target of 5,000 players a month is being backed by an extensive promotion and publicity campaign. The initial disc catalogue features 70 discs and another 40 will be added during the year. The player retails at roughly £500, with the discs selling at £9-18. The latest on the UK launch of the system is, we quote "Philips has not yet specified an actual launch date for LaserVision, but Gerry Harrison (Philips' commercial manager) emphasizes the high degree of consumer research and trade liaison currently being carried out to ensure a rapid and thoroughly prepared introduction of LaserVision."

Hitachi, while producing Selectavision players for the US market, have adopted the JVC VHD system for domestic production.

TRANSMITTER NEWS

The following relay stations are now in operation:

Ipstones Edge (Staffordshire) TV4 (future) ch. 53, BBC-1 ch. 57, Central Independent Television ch. 60, BBC-2 ch. 63.

Romaldkirk (Co. Durham) Tyne Tees Television ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.

St. Anthony-in-Roseland (Cornwall) Television South West ch. 23, BBC-2 ch. 26, TV4 (future) ch. 29, BBC-1 ch. 33.

Weaverthorpe (N. Yorkshire) BBC-1 ch. 55, Yorkshire Television ch. 59, BBC-2 ch. 62, TV4 (future) ch. 65.

Wivenhoe Park (Colchester) TV4 (future) ch. 54, BBC-1 ch. 58, Anglia Television ch. 61, BBC-2 ch. 64.

The above transmissions are all vertically polarised.

With the bringing into operation of the fourth IBA regional operations centre (ROC) at Black Hill near Glasgow the entire ITV transmitter network is now being supervised from just four centres. The other computer-based ROCs are at Croydon, Emley Moor and St. Hilary (near Cardiff), the whole system forming one of the largest and most sophisticated TV transmitter networks anywhere in the world. Black Hill is the control centre for Central and North Scotland, The Borders, Northern Ireland and the Isle of Man, covering 17 high-power transmitters and some 150 low-power relays.

To provide visual quality assessment of the off-air pictures being radiated in each ITV region, the ROCs have receiving aerials capable of providing good-quality pictures from distant transmitters. Since it's impossible to receive high-grade off-air pictures from Ulster and The Boarders at Black Hill however microwave links are used for the purpose. The TV4/Sianel 4 Cymru transmitters will be controlled from the same centres.

TV PARTS CATALOGUE

The 1982 Willow Vale trade catalogue is now available from Willow Vale Electronics Ltd., Old Hall Works, Arborfield Road, Shinfield, Reading RG2 9DP. "Everything for the service engineer" as it says on the cover, and it's certainly a comprehensive (over 250 pages) and well illustrated catalogue. There are fully illustrated sections on droppers, e.h.t. triplers and line output transformers, and the "specific chassis spares" section runs to 70 pages.

MULLARD PAL/SECAM/NTSC DECODER CHIPS

Three new colour decoder chips have been introduced to complete a range that started with the TDA3560 single-chip PAL decoder. The TDA3561 is pin-compatible with the TDA3560 but includes extra features such as a line period delay for the peak-white limiter and a black-level/output ratio of less than two per cent between different channels. The TDA3562 is also similar to the TDA3560 but is not pin-compatible: it has

contrast control of inserted RGB signals, black-level compensation for the tube ageing, and the ability to decode NTSC transmissions in conjunction with a hue control.

The TDA3590 is something quite different. It's a signal processing i.c. for inclusion ahead of the decoder i.c. It leaves an incoming PAL signal unchanged but automatically converts SECAM signals to the PAL standard. Thus a TDA3590 with a TDA3560 or TDA3561 provides a PAL/SECAM decoder, whilst a TDA3590/TDA3562 combination forms a PAL/SECAM/NTSC decoder. Mullard comment that the TDA3590 has undergone extensive field testing and gives excellent performance even with non-standard or reflected incoming signals.

VIDEO PHOTOGRAPHY

Sharp will be joining Sony in the video still photography market towards the end of next year (see article on the Sony Mavica camera in our January issue). It seems that the two companies will adopt a joint standard. Incidentally, the Mavica camera photographs a half frame, the other 262½ lines (525-line system) being produced by the processing circuit, using line averaging.

SANYO VHS MACHINES

For some time Sanyo have been producing both VHS and Betamax VCRs for the US market. The VHS machines are sold under the Fisher brand name, and it seems that Sanyo intend to introduce a PAL version of the machine on the UK market using the same brand name.

SONY NEWS

Following the C5 and C7, what next? The answer is the C6, Sony's latest offering in the VCR field. It's certainly an interesting machine, aimed at the lower price end of the market and featuring front loading, the cassette being inserted through a letter-box type flap. The machine has all the usual features, including remote control, shuttle search and pause, and it will be the first time that a mains-operated Sony Betamax machine is simultaneously launched on the PAL and NTSC (as the SL5000) markets.

Sony are also introducing a new portable VCR, Model SL-F1E (SL2000 in the NTSC version). This really is portable – only 8cm. thick, about the same width and depth as this magazine, and weighing 4·2kg. A cordless remote control system is provided, something not usually found with portables, and an interesting accessory is available in the form of the PCM F1 digital audio adaptor. This enables the machine to be used for recording high-quality digital stereo sound signals instead of video.

Sony are introducing the HVC2200 camera to replace the HVC2000.

MULLARD'S S^2P^2 TV PACKAGE

A very economical TV receiver package has been introduced by Mullard, called S^2P^2 (single-switch power pack). The heart of the circuit configuration was described in last November's *Teletopics* – a chopper circuit that also drives the line scan coils. Fig. 1 shows the basic elements in a bit more detail. The key component is transformer type DT2076/80, from which all the supplies, including the e.h.t., are derived. It also

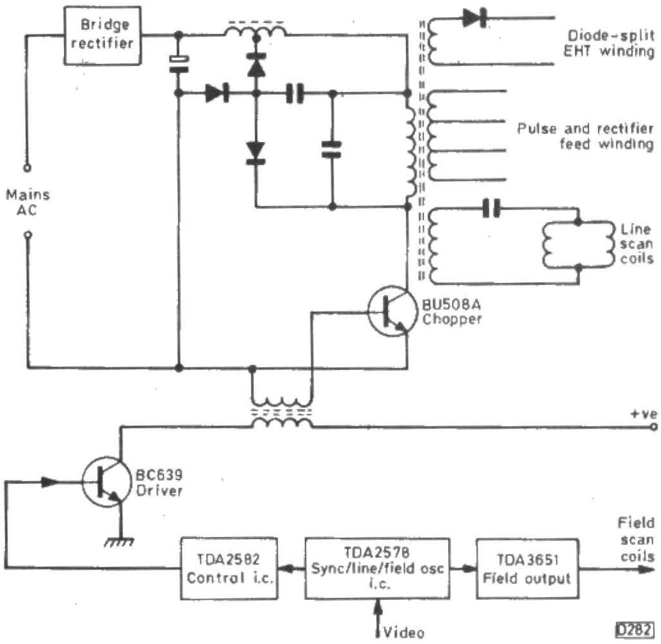


Fig. 1: The Mullard/Philips S^2P^2 power supply/timebase configuration for use in small-screen colour sets.

drives the line scan coils and provides mains isolation to IEC65 standards. Three i.c.s complete the timebase/power supply system, a TDA2582 to control the chopper, a TDA2578 which accepts the video signal and contains the sync, line oscillator and field oscillator circuits, and a TDA3651 to drive the field scan coils. This lot can be accommodated quite easily on a PCB of only 200 × 212mm. The use of this system with an i.c. i.f. strip and single-chip decoder gives a very compact chassis for driving the smaller-size colour tubes that require no EW correction.

CHANGE OF NAME

Once it was British Radio Corporation, then it became Thorn Consumer Electronics Ltd. Time to amend your address book again – it's now Thorn EMI Ferguson Ltd. The aim is to link more closely with the company's corporate identity and emphasize the main brand name.

AGREEMENT ON COMPACT CASSETTE STANDARD

At last some good news about video standards: Philips, Grundig, Matsushita, JVC, Hitachi and Sony have agreed to a common standard for the coming generation of compact-cassette combined video camera-recorders. The agreed specification is still provisional however, leaving certain details of the overall system to be worked out.

The new cassette will be slightly smaller than that used in the Philips/Grundig V2000 system and will have a playing time of one hour. A new tape material, which could be either a metal-powder or vacuum-coated tape, will be needed. In either case new video heads, which cannot be made using existing techniques, will be required. Working cam-corders using the new standard are expected to be demonstrated later this year, though volume production is unlikely until 1985. It is emphasized that the new standard for "8mm video" is not intended to replace any of the existing domestic VCR formats (VHS, Beta and V2000).

Varicap Tuning System

Roger Bunney

LAST month I described a front-end i.f. amplifier system which can be used to obtain two different i.f. bandwidths in conjunction with a standard system I TV set. This follow-up article describes a simple power supply system which, with a suitable tuner unit, makes it possible to tune over the v.h.f./u.h.f. TV bands. The tuner featured is the ET021, which was described by Hugh Cocks in the November 1981 issue.

The power supply/varicap tuner arrangement I've been using until recently was described back in October 1973. I've stripped out all the components apart from the mains transformer, mains socket, mains switch, fuseholder and neon and rebuilt it using later i.c. stabilisers. In addition, an inexpensive i.c. which incorporates i.f. preamplification and an emitter-follower output stage has been included.

The circuitry (see Fig. 1) is straightforward and no problems should be experienced with construction. The earth connection of IC1 is taken to chassis via a 16V zener diode in order to get a higher output (40V). This supply goes to a 12V regulator (IC2) and, via a 1·8kΩ resistor, a TAA550 33V stabiliser, the latter giving a very stable tuning voltage supply. The 7824 i.c. is intended for chassis mounting, and care must be taken to ensure that it is not in direct electrical contact with chassis (if a metal/diecast box is used to house the unit). It's helpful to bolt the i.c. to chassis during construction however, then to remove the bolt and place a thin mica sheet beneath the i.c. for isolation – glue it to prevent it slipping. Note that mail order voltage regulators rarely come with an earth isolation mica kit, whereas the RS Components ones do! Ensure that the 0·1μF decoupling capacitors are mounted adjacent to the i.c. pins.

The lead between the fine tune control and pin 3 of the tuner unit should be screened if it's more than several inches long or if it passes near the mains transformer (use thin screened audio cable, earthed at the tuner). Pin 3 is decoupled by an 0·1μF capacitor to remove hum – the value of this decoupler can be up to 0·68μF, but higher values can give rise to tuning lag. The 100kΩ resistor from pin 3 to chassis increases the current flow and thus provides a wider range of fine tuning adjustment.

The tuner's i.f. output, which has a very broad response, is fed to a Plessey SL521 i.c. that contributes a further 12dB i.f. gain. These i.c.s are available cheaply or can be purchased unmarked at several for £1 from surplus dealers such as Birketts – they are advertised as "radar amplifiers". They can also be used as wideband r.f. amplifiers at up to 60-80MHz, providing a voltage gain of 12dB with a noise figure of typically 4dB.

The 50μA meter movement is adjusted by the 2·2MΩ preset for full-scale deflection at the maximum tuning voltage – set it at mid-travel before switching on to avoid a sudden flow of current through the meter, or include an additional current limiting resistor of say 180kΩ.

Since my previous tuner housings were being used I was obliged to employ separate toggle switches for v.h.f./u.h.f. and Band I/III selection – obviously a single one-pole, three-way switch could be used.

A very versatile DX-TV receiving system is provided when this tuning arrangement is used in conjunction with the i.f. amplifier system described last month and a modern, high-gain receiver. One problem that has been noticed is patterning when operating at u.h.f. and tuned to approximately ch. E28 (the same as the output from the up-converter). A further unit to be described combines filtering (to remove this patterning), variable attenuation and further bandwidth restriction (down to 2MHz). ■

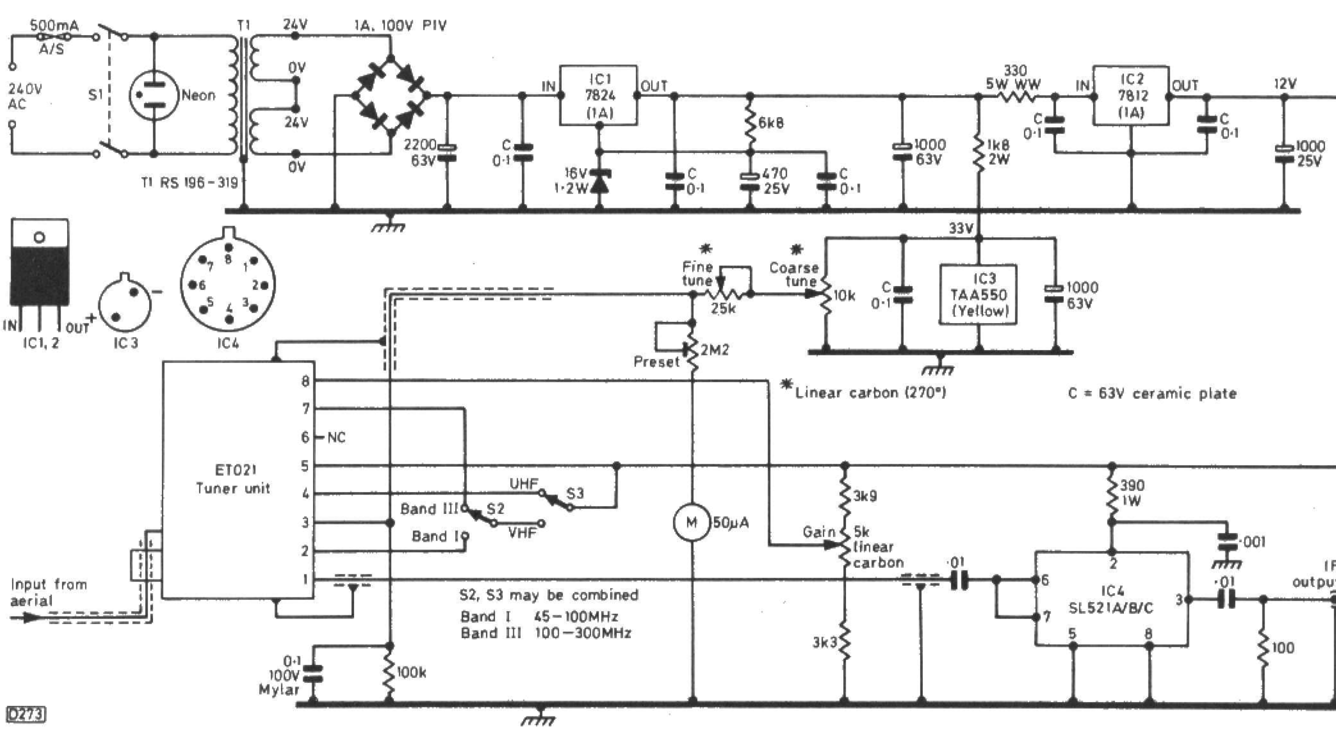


Fig. 1: New varicap tuning system, with i.c. regulators and an i.f. preamplifier.

Letters

GUIDE TO VIDEO

There are a couple of points that perhaps ought to be made in connection with Part 1 of the *TV Man's Guide to Video*. The first is a fairly minor one, concerning the statement that time is always shown following the 24 hour convention. In fact the Hitachi machines have a 12 hour a.m./p.m. clock. The second point is more serious and concerns the use of a line connector and coaxial lead to replace the lead supplied if this is damaged or missing. Whilst this will of course work and is o.k. as an emergency measure, it should be noted that some VCR-to-TV connecting leads, e.g. some Hitachi and Ferguson ones, contain an isolating network to protect the machine and the user in the event of the VCR being connected to a TV set with a live aerial socket. The chances of this happening are small, and the point doesn't arise with all VCRs, but where matters of safety are involved it's best not to take chances.
Derek Snelling,
Brownhills, Staffs.

SYSTEM SWITCH TROUBLES

In his article on the Thorn 2000 chassis Bob Walker comments on avoiding problems by conversion to single-standard operation. How true! The example that came my way not long since was a dual-standard monochrome set fitted with the Philips 210 chassis. It had been given to a relation of mine and when I first saw it the picture had a rather washed out appearance – there was obviously a need for increased contrast, but the control had little effect. I hadn't a PFL200 video/sync valve with me at the time, so I left it at that. Some time later I was again at the house, and this time the sync was rather poor as well. I decided as a start to solder up all the system switch contacts, including the tuner. This took me rather longer than expected, and as I'd no time for further fault finding I replaced the back and switched on. This revealed a great increase in both the contrast and the sync performance, so much so that the tube could be seen to be in very good condition.

I've taken the same action previously with one of these sets that was thought to have a poor tube. It's still going strong, despite the fact that it had been cast out as being beyond economic repair.

How difficult life was made by the system switch!
A. R. Dent,
Sheffield.

SKANTIC PSU MODULES

In my article on servicing Skantic power supply modules (January) I mentioned a quick test for the absence of start-up pulses when confronted with a dead set – to connect an AVO meter between the base of the chopper transistor and chassis. Unfortunately I said with the meter on the resistance range, whereas I'd intended to say on the 500V range. The point is that if the chopper fails to start the −290V supply will of course be present, and will appear at the base of the chopper transistor via RN09, RN13, DN06, pins 5-7 of the transformer and LN02/RN12. Connecting the meter in this way on the ohms range may work, but the possibility of damage depends on the effectiveness of the meter's cut-out. So do it with the meter on the 500V range.
John Brown,
East Grinstead.

PLUG TROUBLE

I've had that fault on the Rank T20 chassis – the screen intermittently flashing brilliant white (*Service Bureau*, January) – on several of these sets. It can be tricky to deal with because of the short time during which the fault is present. The remedies suggested are perfectly correct, but it's easiest to check the decoder plug on the print side of the panel for a build up of flux on the pins due to the soldering conditions during manufacture. The fault can sometimes be instigated by moving the plug.
J. Coombes,
Dawlish, Devon.

FEEDBACK FAULT

An error got into my article on servicing the power supply used in the Pye 731 series chassis whilst it was being edited. If the value of the feedback resistor R897 falls, the h.t. voltage will fall – since the base bias applied to the control transistor VT902 will rise, its increased conduction delaying the charging of C900. Conversely, if R897 rises in value, so will the h.t. voltage.
John Law, T.Eng. (C.E.I.),
Yeovil, Somerset.

2000 CHASSIS MODIFICATIONS

I was interested to read Bob Walker's article on the Thorn 2000 chassis in the January issue. About six years ago I bought several of these sets and distributed them amongst relatives. Most of them continue to give good service, and the following points may be of interest to others still keeping these sets going.

Under bad reception conditions, e.g. ghosting, there's a tendency for the colour intensity to vary and drop out, especially on a highly saturated blue picture. This is due to the burst gate being open for too long. The gate's open time can be reduced by removing C30 (47pF) and shunting R34 with a germanium diode (anode to R2, cathode to C29). It should be noted that this modification will necessitate more careful setting of the line hold control if accurate burst gate timing is to be achieved.

In the event of failure of one or both of the line output transistors, I've found that an effective repair can be made by fitting a single R2008B transistor and converting the stage to single transistor operation. I adopt the following procedure. Remove the "upper" transistor VT4: short-circuit its collector-emitter connections but leave its base connection open-circuit. Cut the track between the emitter of VT4 and the junction of C21/C22/C18/R22. Fit an R2008B transistor in the VT5 position, and uprate its protection capacitor C33 to 1kV working.

Finally, the tripler. Having been unable to locate a replacement, I purchased a cheap ITT CVC5 type tripler from Sendz Components. Unfortunately the VDR in the old tripler must be retained since it forms part of the e.h.t. regulation system. I removed the

diodes and capacitors from the old tripler, also the input lead, leaving just the VDR and the lead to the focus unit. The output lead from the ITT tripler was soldered to the junction of the c.r.t. connector and the VDR. The exposed parts of the old tripler were then covered with silicone rubber sealant, and the old input lead was attached to the new tripler which was mounted on the chassis. This Heath-Robinson combination has been resorted to on a number of occasions and has proved to be a satisfactory repair.

I hope that these simple modifications will prove of help to others.

J. R. Stevens,
W. Ealing, London.

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling, Mike Sarre and C. S. Wood, T.Eng. (C.E.I.)

A Grundig 2 × 4 Plus was collected by Andy from one of our customers, the complaint being that it wouldn't play back in colour. Fig. 1 shows the colour playback system. We first made some checks around the 625kHz voltage-controlled oscillator. Confirmation that it was phase locked was obtained by using a double-beam scope to compare the line sync pulses (fh) with the feedback pulses (f'h) to the phase comparator: since these were synchronised, the output from the oscillator must be at 625kHz. The next check we made was at the 5·058MHz output from balanced modulator 1. This was present and at the correct level, so we followed through the signal path – and found no output from the bandpass filter. Now this doesn't mean that the filter network was faulty or off tune – it could mean that the 5·058MHz signal was not actually at 5·058MHz. Unfortunately it can't be easily measured during playback, due to the timing variations of the off-tape sync pulses in the 625kHz oscillator's phase-locked loop. The output from the 4·433MHz crystal oscillator, the other input to balanced modulator 1, can be checked however – and was found to be 4·47MHz. A new crystal restored the colour.

We also noticed that the automatic programme finder on this particular machine wasn't working. The system works as follows: on record, the erase head is used to record a pulse at the start of a programme, the erase head then detecting the change in d.c. level on playback. The fault was traced to an LM324 quad operational amplifier i.c. – one of its sections was not working.

The problem with another 2 × 4 Plus was erratic operation. The play indicator LED was flashing, the threading motor was repeatedly going backwards and forwards, and the cassette compartment was travelling up and down – it was quite a display. The clue was in the BWIE pulse output from the control microprocessor i.c. – the pulse train was erratic, causing the play LED to flash. No other function, including stop, could be selected. When the play button was pressed, the BWIE output was loaded down, the fault being traced to dirt across the flexible print which forms the pushbutton contacts behind the keyboard.

S.B.

Ferguson 3V22

Regular readers may recall my mentioning a few months ago the problem of a loose screw in Ferguson 3V22 machines, and my suggestion that it might be a batch problem. Well, I must have had my eyes shut at the time, because I've since realised that the batches of 3V22s we've received in recent months (those with a letter in the serial number) have completely redesigned mechanics (this dawned on me when the take-up clutch I was trying to fit to one wouldn't). The reason the loose screw problem hadn't occurred before was that it wasn't fitted!

That loading gear mentioned by Mike Phelan last month and Mike Sarre the month before seems to have been causing us all problems of one sort or another. The symptom we've had is failure to unlace after a timed recording, and it seems that the redesigned mechanism is the cause. On the earlier versions of the machine, the record and play keys returned to the off position and the tape unlaced at the end of a timed recording. In the later version the keys are not returned to the off position, the tape remaining laced until the customer presses the stop button next morning. The problem is that if the mechanics remain in the laced-up position for this length of time without operating they tend to stick and refuse to unlace.

The Ferguson cure, which seems to work, is to file the sharp edges on the nylon loading gear (see Fig. 2). To do this, turn the machine over, remove the bottom and swing up the main panel. The loading gear is in the rear left-hand corner. As only part of it is visible, proceed as follows. (1) Switch off the mains supply and switch on operate. (2) Insert a cassette and press the play button. (3) Switch on the mains while watching the loading gear. In about 1·5 seconds the first filing point will become

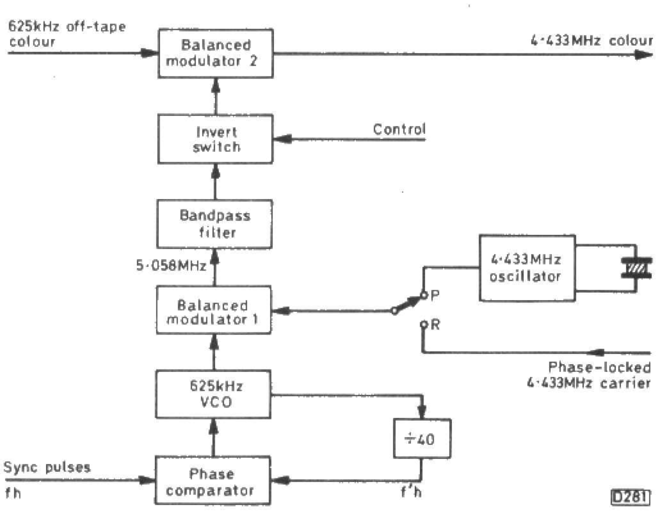
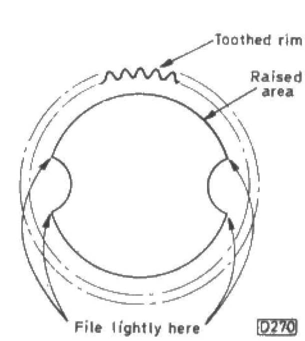


Fig. 1 (left): Colour playback system used in Grundig V2000 type machines.

Fig. 2 (right): Ferguson cure for the loading gear problem experienced with 3V22 machines.



visible. Switch off the mains supply. (4) File the gear, switch on the mains supply and watch for the second filing point. Switch off, file, switch on and allow the machine to unlace. The machine can now be reassembled. **D.S.**

Hitachi VT8000/VT8500

That troublesome 2·2Ω resistor (R081) in the Hitachi VT8000/8500 machines (see *VCR Clinic,* May and July 1981) has now been replaced by a posistor, part number 0249794. It should be positioned in contact with the transistor heatsink on the edge of the main board. **D.S.**

Fault Chart

For ease of reference I've been summarising some of the VCR troubles we've experienced in the past. I hope the list below will be of help to others involved in VCR servicing/maintenance.

All Machines

Buzz on sound: Playback or E-to-E level too high.
Crackle or buzz: Modulator 6MHz oscillator out of alignment.
No record: Check camera and video/TV switches.
Tape threads but will not run on play or record: Check pause socket and remote control.
Picture jitters: Adjust E-to-E playback or modulator.
Incorrect clock functions/operation: Disconnect mains until clock/back-up time runs out.

All VHS Machines

No operation: Check cassette lamp.

Bush BV6900/Toshiba V5470

Flutter on sound: Clean tape spools and pulleys. If o.k., probably the motor.
Record button jumps out intermittently on timer record: Change R619 on servo logic board from 150kΩ to 330kΩ.

All Ferguson/JVC Machines

Tape jammed or not threading: Check capstan motor belt on top of machine.
Incorrect drum speed (line slip): Set up drum servo. Drum motor or flywheel slipping.

Early Ferguson/JVC Machines

Tape threads then unthreads after three seconds: Drum flywheel slipping.
Take-up slows and chews tape intermittently: Replace take-up clutch.

Ferguson 3V22/JVC HR3320

Intermittent jamming and threading: Clean capstan belt and pulleys or replace belt.
Cassette will not lower intermittently: Spring on right-hand back of cassette carriage.

Ferguson 3V29

Sticks on one channel: Check for dry-joint on Q207.

Hitachi VT8000 Series

Intermittent rewind: Change rewind motor.

Panasonic NV7000

Threads then unthreads immediately: Replace loading belt.

Sanyo VTC9300

Clock or otherwise no go: Check 12V regulator transistor Q702 on W3 board.
Clock inaccurate: Reduce value of R1633 on timer board W20 to 5·6kΩ. Add an 0·1μF capacitor between pins 3 and 6 of i.c. Q1618 and between the base of transistor Q1608 and chassis.
No i.f. sound: Check L905 (possibly open-circuit) and i.c. Q906 (AN240) on W5 i.f. board.

Sony SL8000

Record button will not stay down: Check connections on supply sensor board.
No buttons will lock: Belts off. **M.S.**

Bush BV6900A

The fault we had with a Bush BV6900A was that if any key was depressed, e.g. fast forward, rewind, play, record etc., it would be released 3-4 seconds later. We removed the top and discovered that the capstan and drum motors were running much too fast. Hence the keys being released, as the PW2110 system control board would detect the fast motors and release the keys.

IC501 on the PW2110 board is common to both the capstan and the drum servos, so this seemed a good place to start. The voltages and waveforms around the chip were checked, everything being o.k. except for pin 15 which had no waveform and almost zero voltage on it. Pin 15 is a flip-flop output however and is concerned with the drum servo only. Perhaps the chip was faulty? A replacement from a second machine which was waiting for a timer i.c. was tried, but the fault remained. Next try replacing the whole panel. Still no luck.

Ring Bush who suggest checking the frequency of the clock pulses at pin 1 of IC501. Do this with a frequency counter but find them spot on. Check power supply rails for a second time but everything o.k.

Decide to do some more panel swapping. Change the PW2117 speed control and logic board. Fault persists. Change the PW2115 drum drive circuit board, fault now cleared. But how can the drum drive board alter the speed of both motors? Well, the clock oscillator is common to both servos and is mounted on this board – but the frequency had already been checked and found to be spot on. Voltage checks were carried out on the clock oscillator without revealing anything amiss, so we next started making resistance checks of the components in the circuit. The culprit was eventually found – C964, which couples the pulses (see Fig. 3) from Q964 to pin 1 of IC501. It was short-circuit. The voltages at pin 1 of IC501 and the collector of Q964 were both correct however. Not an easy one! **C.S.W.**

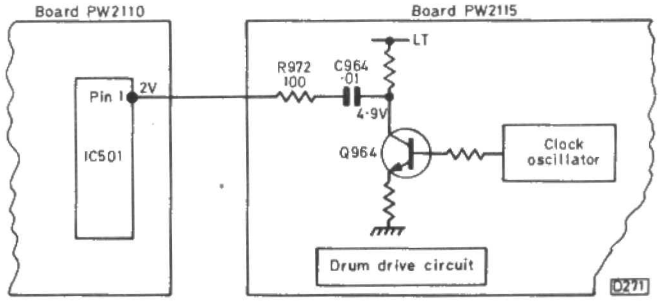


Fig. 3: Bush BV6900A control system fault.

Long-distance Television

Roger Bunney

FIRST a brief résumé of the main UK DX-TV highlights of 1981. Sporadic E propagation provided exotic signals for most enthusiasts – for example Jordan ch. E3 was widely received; a noise-free, double-hop ch. E3 signal from NTV (Nigeria) was received in the Midlands on July 4th; Puerto Rico ch. A2 (system M, 525 lines) was received via multiple hop on July 10th; and on June 7th there was record Band III SpE propagation, with several TSS (USSR) channels up to ch. R11 being seen.

F2/TE propagation provided further drama in Band I, with mystery signals abounding on chs. E2 and 3 and A2 to the east, and regular reception of signals from Russia, Dubai, Zimbabwe, Ghana and Nigeria on chs. E2/R1/E3. Tropospheric propagation had its moments, though there were no particularly eventful openings during 1981. Certain of the new French system L Band I/III transmitters are now on test and being regularly received along the south coast. Auroral propagation has given us N. American signals on isolated occasions.

CB interference became a major problem during the year – so much so in some cases that Band I DXing became impossible. The problems seem to be easing with the advent of higher specification equipment using f.m. Another problem is the appearance of cheap and nasty walkie-talkie apparatus operating at 49·86MHz – more on this later.

Generally a good year then, and for the new year we can predict a slow decline in F2 activity, whilst reception conditions for some will improve as the UK 405-line Band I transmitters start to close down. Satellite activity is on the increase, and we're at present looking into the possibilities of 4GHz reception using simple to make equipment that can be commissioned without recourse to expensive test gear. More on this in the future if we can make the thing work!

Now to December 1981. Tropospheric reception was excellent on December 3rd, with central European Band III/u.h.f. stations being received along the east coast. In the south reception was predominantly along a north/south line. The best signal received here at Romsey was from Caldbeck (Border TV) on ch. 28. RTE (Eire) transmitters were widely received over the central/southern UK. A further opening on December 19th produced French u.h.f. signals in Lancashire. The Geminid and Ursid meteor showers produced very strong signal pings and longer duration bursts in Band I. There were characteristic mid-winter SpE openings as follows:

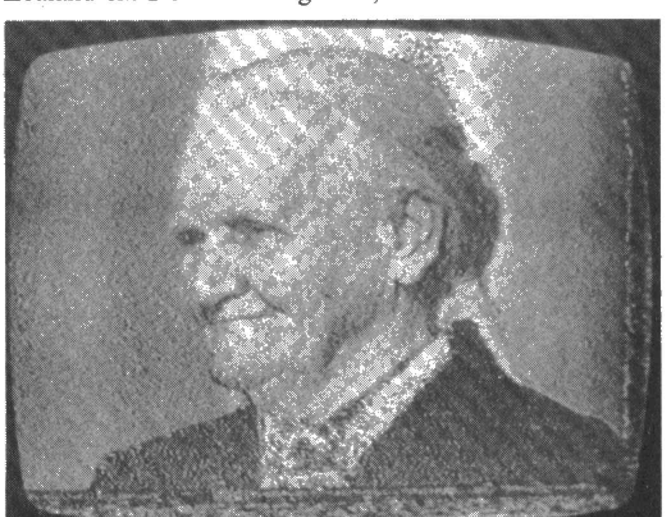
7/12/81 TVP (Poland) ch. R1, 2; TVR (Rumania) R2.
11/12/81 RTVE (Spain) E2, 3, 4; RTP (Portugal) E3; RAI (Italy) IA, B.
13/12/81 TVP R2; RUV (Iceland) E4.
14/12/81 CST (Czechoslovakia) R1, 2.
21/12/81 TSS (USSR) R1 – consistent signals of an ice-hockey match during the late afternoon.
22/12/81 CST R2; TSS R2; JRT (Yugoslavia) E3.
27/12/81 WG (West Germany – SWF) E4; RTVE E2, 3.

F2/TE propagation was very active during the first two weeks of December. Between the 3rd-8th inclusive, and also on the 12th and 14th, TSS signals were received at generally high levels, with one or more signals on ch. R1. On a good day the channel becomes blocked. The 3rd was interesting since single-hop F2 propagation from the Moscow region was prevalent – unusually, the digital clock (plus three hours GMT) could be read. Ch. E2 was less active, though Dubai was seen on the 5th, 8th, 9th and 14th and suspected on the 24th: Arthur Milliken (Wigan) identified GBC (Ghana) on the 12th. There has been some of the best quality reception ever seen on ch. A2 from N. America. Hugh Cocks first heard signals on the 5th, using an SX200 scanner – with the characteristic sharper buzz from the video signal. From the 6th-15th inclusive programme material was seen in the UK and Holland, during the period ranging from 1330-1700. Hugh managed to identify CKCW (Moncton), and the source of a breakfast show called "AM" is at present being investigated – it was seen floating with CKCW on the 11th. Here at Romsey the local Rowridge transmitter was inoperative (aided by the blizzards) from 1440 on the 13th, and ch. A2 was seen with excellent quality – at optimum clarity around 1500 the programme continued without any identification or break. There was also a suggestion of Auroral aided ch. A2 signals on the 13th.

Quite a good month then, and my thanks to Arthur Milliken (Wigan), Hugh Cocks (E. Sussex), Nick Brown (Rugby), Cyril Willis (Cambridge), Petri Pöppönen (Finland) and Ryn Muntjewerff (Holland) whose reports supplemented by own loggings.

There's been a fall off in F2 reception by our Australian friends. Late November was extremely active – on the 23rd Anthony Mann (Perth) had BBC-1 up to ch. B2 sound, European test cards on ch. E2 and strong Chinese video on chs. C1 and 2. On the 22nd the Chinese were observed to carry a commercial during a sports programme. Much of the propagation from Japan/China is via TE, aided by SpE ionisation – it's now the peak of the SpE season down under. On the 22nd the MUF reached ch. C2 sound (64·25MHz), and AFKN Seoul, S. Korea was viewed with "Star Trek"!

Robert Copeman and Wenlock Burton in Melbourne confirm that SpE reception has been excellent – hopefully a pointer to good European conditions some five months hence. Following Robert Copeman's reception of New Zealand ch. 1 on a moving train, Wenlock claims to have



Reception from the Russian Stat-T satellite, at 714MHz, by Ian Roberts in South Africa – showing typical picture quality.

done one better – with reception of the same channel on a portable set whilst walking down to his local shop!

Holiday DX Reception

Hugh Cocks has been on holiday for a week in South Portugal, where he rejoiced in the sun – and good DX conditions. He had with him a 1in. Sinclair set, an all-band tuner and an 18ft. length of wire. Using this he first obtained MS signals, confirming that low-level signal reception was possible. For most of the time there was no F2 reception, though nightly TE propagation produced exceedingly strong signals. His log reads as follows:

21/12/81 GBC (Ghana) ch. E2 from 1700-1830, blurred with ghosting but no flutter. At 2130 ch. E3 overloading, with coloured announcer in fez plus floater, fading at 2205.

22/12/81 NTV (NTA – Nigeria) E2, 3, 4 from 2030-2230, sound and vision with several transmitters per channel. Programmes in English or African languages, with most channels jammed. NTV Sokoto now uses the identification "NTA Sokoto". At 2108, reference in English to Sierra Leone.

23/12/81 Signals on chs. E2, 3, 4 at overloading levels, mainly NTV/NTA on non-network programmes.

24/12/81 Programmes on chs. E2 and 3, weaker this night.

25/12/81 Morning F2 reception of ch. E3 African station from 0930-1015. Usual evening TE reception with many signals on chs. E2, 3, 4. GBC ch. E3 confirmed by "stay tuned" caption.

26/12/81 As previously, with "NTA Network Programme" caption, also NTA news with dark announcer wearing fez and caption "NTA News". At 2115 a Christmas message from the Freetown Management Committee, confirming reception of Sierra Leone. The transmission (ch. E2) closed with African music and, at 2210, a checkerboard pattern. The field blanking pulse is very narrow, unlike Gwelo ZTV which has a wide blanking pulse.

27/12/81 Different this time, with SpE signals from the UK (chs. B1, 2, 3), France (TDF ch. F2), Holland (NOS ch. E4) and Belgium (RTBF ch. E3).

After that Hugh returned to the snow, ice and 49·86MHz interference in the UK! Hugh comments that the GBC signals suffer on all channels from video flashing and hum on sound. A good day will give reception on chs. E2, 3 and 4 with sound and vision while a poor day will give signals up to ch. E3 vision. There's no Band I activity in S. Portugal (apart from very weak Guadalcanal RTVE ch. E4), and Band III is relatively quiet. Reception of the same African stations night after night would become rather boring, but the joy is the complete lack of interference.

News Items

Italy: A fourth national TV network, "RETE 4", was scheduled to come on air on January 1st. It's based on a merger of established major independent stations, with twenty or so transmitters giving virtually countrywide coverage.

Finland: YLE has commenced a teletext service with an 80-page magazine. There's a plan to enable registered deaf people to purchase teletext equipped sets at the price of an

ordinary TV receiver.

Middle East: Bud Lloyd-Bennett (Dhahran, Saudi Arabia) reports that an AFRTS transmitter is in operation to the ESE of his location, on ch. A3 – signals weak but consistent . . . Iran TV is restoring certain transmitters and a new outlet has been opened at Lordegan (ch. E4) . . . A move towards cable TV has been announced in Israel, and discussions on channel allocations are taking place with Jordan and Egypt with a view to minimizing future interference.

New EBU Listings

W. Germany: Rhoen ch. E37, 350kW horizontal (third programme).

Spain: San Roque RTVE-2 ch. E37 40kW e.r.p. horizontal; Chinchilla RTVE-2 ch. E43 158kW e.r.p. horizontal.

Poland: Pila ch. R2 50kW horizontal; Walcz ch. R2 has closed down.

Transmitter Guides

The latest IBA pocket transmitter guide lists the new programme contractors and indicates which TV4 transmitters are now operational. RTE (Reception Investigations, Donnybrook, Dublin 4, Eire) have published a card folder on the RTE u.h.f. service and a card folder on RTE-1/2 reception and aerials. Both folders include coverage maps and channel information.

From our Correspondents . . .

Nicholas Brown (Rugby) has been very active this past summer/autumn, using a WB5/6 series omnidirectional wideband Band I aerial, Jostykit HF385 aerial amplifier, upconverter and u.h.f. TV set. Unfortunately a local CB operator, Herman the German, has been causing interference – strangely at around 80MHz, which is not a normal harmonic. Nick suspects that the cause is overloading – the Daventry BBC World Service also tends to break through at times. A simple high-pass filter at the input to the amplifier should remove the BBC signals (e.g. two series 100pF capacitors with the centre point connected to chassis via a ten-turn v.h.f. choke), while Herman could possibly be silenced by using a GPO type 38A high-pass filter in conjunction with a braid-break filter or the ferrite toroid treatment described in a previous issue. Nick has also sent us an excellent shot of the NRK (Norway) PM5544 test pattern which he received on ch. E2 last summer via SpE.

Colin Challen (4 Dudley Avenue, Mayfield St., Hull HU3 1PF) is doing research for a book on community TV stations. He would like to borrow any books, documents etc. on the subject. These would be acknowledged and returned in due course.

Dave Beaumont (Rainham) reports noise-free reception from the Midland, Yorkshire, Tyne-Tees, Anglia, Southern and London commercial transmitters during the north-south tropospheric opening on December 3rd, using an unmodified, ex-rental Luxor TV set.

Gosta van der Linden of the BDXC DX Club reports that one of their members (Henry Peters) has recently been in Malta. The only transmitter now in operation is Ghargur ch. E10 (10kW e.r.p.), 6km west of Valetta, the Tivumalta ch. E21 transmitter having been closed. "TVM Television Malta" provides the programmes, which are transmitted (with PAL colour) by the Zandir Malta state broadcasting service. The PM5544 test pattern has "TVM" at the top and "ZANDIR MALTA" at the bottom. The Italian RAI transmissions are received in Malta and, at reduced quality, various Sicilian "free" transmitters.

Correction

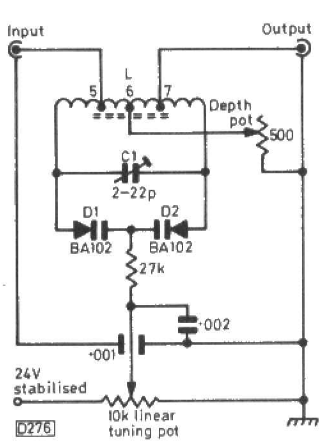
The Iranian FUBK test pattern photograph shown in the January column was photographed in Iran, not Finland. The photograph came from an Iranian friend of Petri Pöppönen.

49MHz Walkie-talkies

You can at present visit your local CB shop, toy and certain general radio emporia and buy a 49MHz walkie-talkie set. These cheap(ish) transceivers are designed to operate at 49·86MHz with a power of a few mW, giving a theoretical range of several hundred yards – though in practice the range may be considerably greater. The units are imported from the Far East, and though it's not illegal to offer them for sale it's illegal to use them. As 49·86MHz falls within a band that's officially allocated for TV broadcasting, they are unlikely to become legal. There are also cordless phone operators using the frequency, but since the cost of this equipment is relatively expensive it's unlikely to come into wide use.

Whatever the legalities, the 49·86MHz problem is with us. CB is not such a problem now that f.m. equipment built to certain standards is being generally used – but we now have this in-band interference source that shouldn't be there. In some areas, chs. E2/R1 are saturated on Saturdays and school holidays.

The 49·86MHz interference could be removed by using a sharp notch filter, but the trouble is that the ch. R1/E2a vision carrier (49·75MHz) is only some 100kHz away and will thus suffer undue attenuation. One could move the notch higher and settle for less attenuation along the slope of the filter's response curve, but either way ch. R1 will suffer. The size of Band I aerial structures also means that it's difficult to mount them higher with screening elements beneath, while the random polarisation of the transmissions makes it impossible to avoid them through careful aerial positioning. As you'll appreciate from this, it's a problem I've had at first hand – on Christmas Day chs. R1/B2 were completely jammed with the things . . . So any suggestions from readers will be of interest.



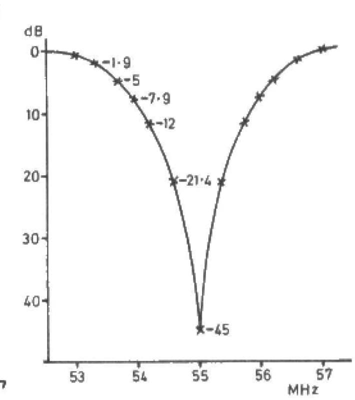


Fig. 1 (left): Varicap-diode tuned notch filter for Band I use. C1 is a miniature foil trimmer (green) – from Ambit or RS stockists. The coil consists of 11 turns of 18 s.w.g. tinned copper wire, 7/8in. long and 5/16in. diameter, tapped at turns 5, 6 and 7. For core details see text.

Fig. 2 (right): Plot of the notch, measured with a test frequency of 55MHz at 75Ω.

I've sent a letter to local media in the hope that it will draw attention to the problem, and have also written to the Minister of State at the Home Office (Timothy Raison, M.P.) to establish what the "official" attitude is to the encroachment of illegal signals into Band I and whether anything is likely to be done to prevent the sale and use of such equipment. His reply will be reported in due course.

Improved Varicap Notch Filter

In the March 1981 column I gave details of a varicap-diode tuned notch filter with several preset positions to remove interference at particular frequencies, and with provision for tuning the notch over Band I. I've recently rebuilt the system to give improved performance, tunable over the range 43-70MHz. The bridged-T tuned circuit previously had a 470Ω preset which was adjusted for maximum rejection at 55MHz and a reasonable notch elsewhere. This preset has been replaced (see Fig. 1) with a standard 500Ω chassis mounted carbon linear potentiometer which enables the maximum rejection notch to be obtained throughout the tuning range, i.e. a notch depth of at least 45dB can be obtained at any point in the range by adjusting the 500Ω depth potentiometer. Also the redesigned coil gives a much sharper notch (see Fig. 2).

The insertion loss is 6dB throughout the range. This is relatively high for DX purposes, but the sharpness and depth of the notch make it possible to include a medium-gain amplifier prior to the filter and still get a notch depth of typically 40dB. For this purpose I've built a wideband v.h.f. amplifier with a lowish noise figure (details to follow in a later issue) covering 48-220MHz – for indoor use. It provides a gain of 18dB in Band I with a noise figure of 3-3·5dB, and uses a very simple circuit.

The notch filter coil uses a "v.h.f. grade" standard dust core – these used to be quoted as $\frac{1}{4}$in. types but are now specified as 6 × 12·7mm long. Maplin list a 6mm core (LB42V) and Denco (Clacton) Ltd. (355-9 Old Road, Clacton, Essex) have several types – if possible, use the Grade 901 (these even have the circular tag rings). Position the core in exactly the centre of the coil, and fix it with a few drops of nail varnish.

Tuning is simple. Set the tuning potentiometer to the interfering frequency (the interference will reduce), then adjust the depth potentiometer – this will produce a sudden fall in interference, which will increase again with further rotation. When the depth control has been adjusted for minimum interference, readjust the tuning potentiometer to ensure that everything is peaked. This should give a 45dB notch, which can of course be moved anywhere within the filter's range.

Construction is simple. Ensure that the coil is wound symmetrically, and that the distance from the centre tap to the depth potentiometer is kept to the minimum. To align the filter, adjust the tuning potentiometer for the maximum voltage (this corresponds to the maximum h.f. coverage). Connect the filter in circuit and tune the TV set to the highest Band I frequency, with a modulated input from a signal generator. Adjust the trimmer capacitor C1 until the rejection notch appears. Optimum h.f. coverage has then been obtained. Adjusting the tuning potentiometer for zero voltage at the slider should then move the notch to below 45MHz. If it doesn't, squeeze the coil turns together slightly until you get the coverage down to 43-45MHz. Finally recheck the h.f. alignment.

The value of a notch that can be moved across the band during active conditions has to be experienced to be appreciated.

Fault Report

Mick Dutton

Telefunken 711 Chassis

The complaint with a Telefunken set fitted with the 711 chassis was that it was stuck on channel one. The set uses touch tuning, with the selectors made up of half-moon touch tabs. A very common fault with this unit occurs when dirt and grease accumulate between the half-moon sections, with the result that the set sticks on one channel or jumps from station to station – some types of spray polish can also cause the trouble, and in this case it's best to strip down the tuning head and clean all the parts with methylated spirits.

The tuning pads looked clean on this particular set however. I disconnected the wiring to the first touch pad, but the set remained stuck on channel one. This suggested a faulty channel selector chip (SAS560), but the fault remained after this was replaced. So all the other components associated with the number one channel selection had to be checked. The fault was eventually cleared by replacing C1109 (33pF) which was short-circuit (it forms part of the ring counter arrangement used).

Thorn 9800 Chassis

The customer's complaint with a Ferguson Model 3745 (Thorn 9800 chassis) was that when it had been on for a while it would start to go off and on. They would then have to turn it off for a while before it would work normally. The set was working correctly when I called, and had been o.k. for most of the day. So I took the back off to look for loose connections, bad joints etc. – in the past I've had problems with dry-joints on the line output stage plugs PL851 and PL852. These were resoldered just to be sure (they can also cause field collapse), and the power supply panel was then checked. There were some very poor connections under all the plugs. These were made good, and as a test card was present everything was set up. There was nothing more I could do, so I advised the customer to call again if there were still problems.

Two days later they phoned up. This time when I called I found that the set was tripping – usually the sign of excessive h.t. or something wrong in the control circuit. The h.t. was correct at 200V however, also the 25V supply. The power supply panel was modified in later production, and as this was an early version the recommended modifications were carried out (change R726 to 10kΩ, R722 to 3·3kΩ, R723 to 5·6kΩ and delete R740 and C720).

The tripping stopped, but there was now poor h.t.

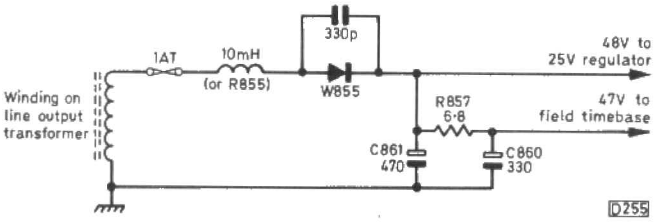


Fig. 1: Derivation of the 48V and 47V supplies in the Thorn 9800 chassis.

regulation, the supply lines varying by 20V with brightness changes. The 25V line was also varying, and the voltage at the collector of the 25V series stabiliser transistor VT702 was found to be low at only 27V instead of 32V. Now the source of this supply is the 48V rectifier in the line output stage (W855 – see Fig. 1). The output from this was way down at only 31V, and when this part of the circuit was examined I found that R857 was dead short and C860 completely open-circuit – these components filter the 47V feed to the field timebase.

Replacing these two components gave us a stable h.t. supply (and also removed a slight hum on the sound), but there were now flyback lines on the top two inches of the picture whilst the new R857 was overheating considerably. Over to the field timebase, where we found the voltage at the collector of the driver transistor VT409 low at 20V instead of 23·8V. The collector circuit contains two diodes to get the correct bias conditions for the class B output stage, and further voltage checks revealed that one of these diodes (W411) was open-circuit (24·5V at the anode, nothing at the cathode). A new diode completely cured this second fault, and I was left thinking that the field timebase must have been operating in a rather unusual manner.

Decca 90 Chassis

The Decca 90 series chassis produces an excellent picture and has proved to be very reliable as far as we are concerned. On one of these sets the customer complained that it "went into lines" after it had been on for a while. A workshop soak test confirmed this, but as soon as we touched the chassis the fault cleared. Tapping almost anywhere on the printed panel produced the fault.

We eventually traced the cause of the problem to a hairline fracture in the print around the edge of the centre tube-base aperture. The print at the top right-hand side of the aperture is very fine and close to the edge of the board – the track concerned connects the 195V supply from the switch-mode power unit to the RGB output stages and the tuning voltage supply circuit. It seems likely that the fracture had been present from new, the fault only showing after the customer had moved the set.

Philips G8 Chassis

The customer's complaint on a Philips colour set (G8 chassis) was that red fringes developed on vertical edges after the set had been on for some time. The set was watched for a while, and the fringes turned out to be due to a convergence error. Adjusting the R/G tilt and parabola controls in the field convergence circuit would remove the error, but as the set warmed up it would drift back again. The trouble was due to the associated coupling electrolytic C1909, which measured almost dead short on an Avo.

Hitachi CNP190

The problem with a 19in. Hitachi Model CNP190 was corrugated verticals. Trouble in the line generator department of course, and it was found that the fault could be eliminated by critical adjustment of the line hold control T701 (it's part of the sinewave oscillator circuit – see Fig. 2). The line timebase would then lock off frequency when the channel was changed however.

Unfortunately the fault would disappear for long periods of time, while the use of a hairdryer and a can of freezer made no difference. I changed the flywheel sync discriminator diodes CR32/CR33, also the line oscillator

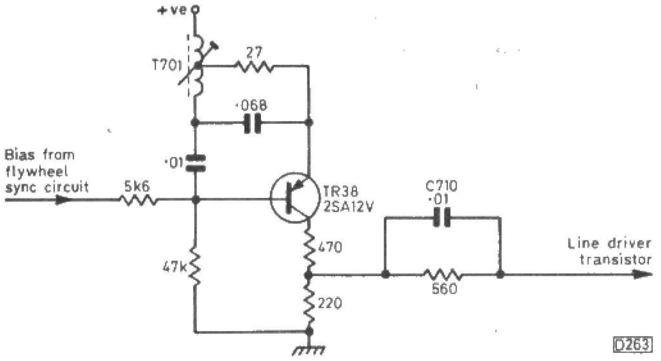


Fig. 2: Line oscillator circuit used in the Hitachi Model CNP190. The stage is a Hartley oscillator, with the transistor's emitter taken to the tap on the coil. This type of circuit was often used in earlier Japanese solid-state chassis, both colour and monochrome.

and phase splitter transistors, but the fault remained. Time to turn attention to the capacitors in the circuit. I must admit that the following checks took some time, and I ended up substituting capacitors one by one. The fault was eventually traced to C710 (0·01μF), which is in the coupling network between the line oscillator and the line driver transistor. It read perfectly on a capacitance bridge!

Thorn 1615 Chassis

I've found two points worth noting with the Thorn 1615 chassis (solid-state monochrome 20 and 24in. models). First, a dry-joint on the line linearity coil L23 can lead to a large hole in the panel, so it pays to check the soldering to this whenever one of these sets is serviced. Secondly the field output transistors VT22/VT23 (T6035V and T6036V respectively) seem to be rather unreliable. They can be responsible for field collapse or just the top half of the scan being absent – both these faults can be intermittent.

Philips G11 Chassis

A set fitted with the Philips G11 chassis had been in service for only a short time when the customer phoned to say that it was stuck on channel one. The set had touch tuning and full ultrasonic remote control. When I arrived at the house I found that the touch sensor was stuck on the first position and that only a grainy picture could be obtained when tuning was tried. I didn't have any service data with me, so I decided to start by checking for 33V across the TAA550 tuning voltage stabiliser i.c. This is in the tuner head, which had to be stripped down. The voltage was only 5V. Following the very thin print brought me to a meaty resistor which was cold and had little voltage at either side. Moving back to the power supply panel brought me to R4079 (6·8kΩ) which provides the voltage feed from the h.t. line. There was 150V at each side of this resistor, i.e. no voltage drop, and the same voltage was present at the connector (4C2). So plug 4C was removed and a check was made on the continuity of the connection to pin 2. It turned out to be virtually open-circuit – the pin connection had been clamped to the insulation rather than to the wire. Remaking the connection restored normal operation.

Rank T20 Chassis

We were led a bit of a dance by a Bush Model BC6348 (T20A chassis). The report was no results, and inspection showed that when the set was switched on it would try to start up and then die. As a first step the back was removed

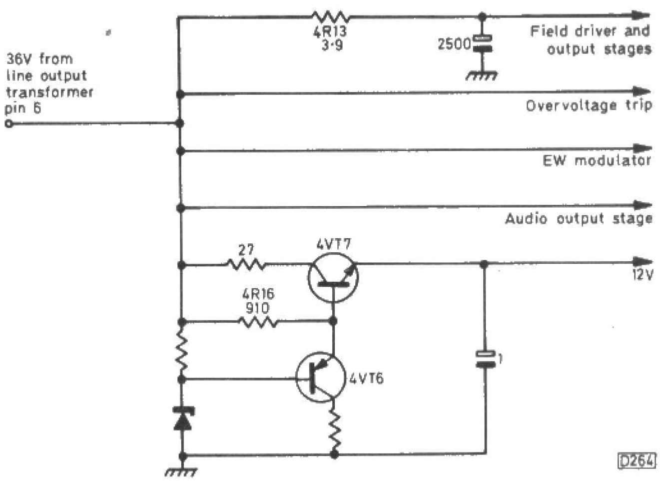


Fig. 3: 36V supply feeds in the Rank T20 chassis.

and the h.t. voltage measured. This was correct at 200V. Next the overvoltage trip was backed off, but still there were no results. Disconnecting the tripler didn't make any difference either.

At this point it seemed likely that something was wrong with the line drive waveform. So a scope was brought into action, and we found that the line drive output from the TBA950 sync/line oscillator i.c. was very low, dying away to almost nothing when the set had been of for a few seconds. A 5·6kΩ resistor was next strapped across the start-up capacitor 4C19 to provide the i.c. with a supply that was independent of the line output stage. This time the set came to life with no trouble at all, but the field scan was much reduced and the height was wavering around. There was also an unpleasant ticking noise coming from the line output transformer.

I switched off and disconnected one end of 4R13 to open-circuit the 36V supply to the field timebase (see Fig. 3). This stopped the noise from the transformer, so I disconnected the 5·6kΩ resistor and tried switching on again. The set was once more dead however – I had assumed that a fault in the field timebase was loading the line output stage, but this was obviously not the case.

What else is supplied from the line output stage derived 36V line? Whilst looking around the timebase panel I noticed that there was discolouration around 4R16: when this resistor was checked, it was found to be open-circuit. This 910Ω resistor provides base bias for the 12V supply series regulator transistor 4VT7, which takes its input from the 36V supply. The 12V line in turn supplies the line oscillator, part of the field timebase and the signal circuits. At last we'd got there: replacing 4R16 restored the set to normal operation. What a lot of confusing symptoms the various interacting circuits caused!

The value of 4R16 appears to be quite critical: I fitted a 1kΩ resistor as a temporary measure, but the 12V supply was not 100% stable with this value.

Thorn 9000 Chassis

The customer's complaint with a Thorn colour set fitted with the 9000 chassis was that it would sometimes go off when the channel was changed, also that it took the picture a time to come right when switched on. The picture appeared when I switched the set on, but there was severe line pairing and the centre of the picture was folded over. This effect disappeared after about half a minute. On changing channels, the set tripped and then restarted.

The tripler was disconnected but the set still tripped on

changing channels. Resoldering several dry-joints around the chopper and line output transformers also produced no improvement. The line pairing effect gave the impression that line pulses were present on one of the supply lines, so I started checking all likely electrolytics. When the 87·9V line's reservoir capacitor C715 (22μF) was removed from the board it was found to have white deposits around its end. Its value was correct, but replacement cured both the line pairing and the tripping on channel change.

Pye 725 Chassis

The fault with a Pye Model CT222 (725 chassis) was no colour. As the decoder uses plug-in i.c.s, I quickly replaced the TBA540 reference oscillator i.c. Still no colour. Disconnect one end of R349 to override the colour-killer action. Again no colour. A quick check of the voltages around the TBA540 i.c. and the TBA560C chroma and luminance signal processing i.c. revealed nothing unusual, so I decided to take the set back to the workshop.

Loss of colour with the colour-killer overridden could be caused only by a stalled reference oscillator or a fault in the chroma channel (no chroma output from the TBA560C). A scope check revealed that the oscillator was working normally but that there was no chroma output at pin 9 of the TBA560C. The only slightly incorrect voltage around this i.c. was at pin 14, which should have been at 1V but recorded 0·85V. This is the a.c.c. input pin, which is decoupled by a 10μF electrolytic (C346). Removal of C346 restored the colour, and on test the capacitor was found to be slightly leaky.

After setting up the decoder, and resoldering all the dry-joints in the i.f. can, a very reasonable picture was obtained.

Philips G8 Chassis

A Philips colour set (G8 chassis) was brought into the workshop as dead, and we found that the 800mA fuse on the line scan panel had failed. A quick meter check showed that the line output transistors were o.k., so we disconnected the tripler, replaced the fuse and switched on. The result was that the fuse blew again almost immediately, a slight puff of smoke coming from R517. This resistor connects the emitter of the line driver transistor T519 to chassis, and on removing the panel we found that R517 was burnt and T519 was short-circuit. These components were replaced, the panel refitted, and the set was confidently switched on. Bang went the fuse, and T517 had again failed. Everything that could be checked easily seemed to be o.k., so I came to the conclusion that the line driver transformer was probably faulty. The primary winding was found to read only some 2Ω, instead of 30Ω with a known good one, a replacement curing the trouble.

Rank Z719 Chassis

The trouble with a set fitted with the Rank Z719 chassis was lack of width. All the voltages were correct, but the line output stage seemed to be generating a lot of heat. Replacing the flyback tuning capacitor 4C28 (0·011μF) cured the trouble – the value of this capacitor is critical for correct line timebase operation. The picture was then set up, but looked dim, while if the brightness control was advanced flyback lines became visible. Replacing the two transistors 6VT1/2 in the blanking/beam limiting circuit on the tube base panel produced an excellent picture, though the transistors read o.k. out of circuit.

Sanyo CTP370

The most awkward fault I've had to deal with recently was on a Sanyo CTP370 colour portable. The problem was field jitter, which could be removed by reducing the setting of the a.g.c. control at the back of the set. The picture was then very thin however, even with the contrast control at maximum. The field hold control had a good lock-in range, and the line lock wasn't affected, so it seemed likely that there was an a.g.c. fault. The a.g.c. circuit consists of a gated triode (PCL84), followed by a couple of transistors. The voltages appeared to be all right, but the resistors that bias the cathode of the triode looked as if they'd been overheating – these are R157 (47kΩ), which is fed from the 312V h.t. rail, and R158 (56kΩ), which goes to chassis. Replacing these produced some improvement, and when measured R158 was found to have changed value quite considerably. The fault was still present however, so I changed the two transistors. Nothing doing. Replace C138 (4·7μF) at the base of the first transistor and get a complete cure. It was then possible to turn up the a.g.c. control and obtain an excellent picture, even without an aerial.

I've since been told that another cause of this effect can be D904 going leaky or short-circuit. This is the dropper diode in the heater chain, and in addition produces across C930 a −10V supply which is used to bias the control grid of the second video amplifier (the pentode section of one of the PCL84 valves).

The JVC CX610GB Receiver/Monitor

David K. Matthewson, B.Sc., Ph.D.

A COUPLE of years ago JVC introduced a low-cost (suggested retail price £250) 5in. colour video monitor, Model TM41. Although the pitch of the tube mask was rather coarse and the colour rendering and geometry not especially good, the set rapidly gained acceptance as a handy and reliable battery/mains colour monitor for location use with professional VTRs as well as for use by more dedicated amateurs. It seemed only a matter of time before a receiver/monitor version would come along, and in due course this put in the expected appearance. Model CX610GB employs the same tube as the TM41, and has much in common by way of the electronics. JVC decided to do more than simply produce a new receiver/monitor however: the CX610GB is capable of working with both PAL and Secam transmissions, operates at both v.h.f. and u.h.f., and has a switchable intercarrier sound section capable of handling 5·5, 6 and 6·5MHz sound signals. This, coupled with a power unit which will run from 12V d.c. or 110-250V a.c. supplies, makes the set suitable for use in a staggeringly long list of countries.

Although the CX610GB is able to decode Secam colour, it can't be used in France – because of the French system L

(with positive vision modulation and a.m. sound). The CX610GB is designed to operate on the following systems: PAL B, G and I, and Secam B, G, D, K and K1.

The design is neat and since the set weighs only 4·6kg it's quite easy to carry – the handle doubles as a support whilst the set is in use. Although it's described as a battery/mains portable, if you want to run it from batteries you will have to purchase either a dry-cell pack or a rechargeable nickel-cadmium unit. Either of these clips on to the back of the set, adding a bit more in terms of weight, bulk – and price (the nickel-cadmium packs cost around £50). You can however run the set from a 12V car or boat supply via a suitable lead. The power consumption is 29W on a.c., 15W on d.c.

A rotary tuner is employed, the ranges being 47-68MHz and 174-230MHz on v.h.f. and 470-862MHz at u.h.f. The control is rather direct, which I suspect could make it a bit tricky to use for DX purposes. It's perfectly adequate for normal use however. There's a small, illuminated tuning scale which, on the sample I had for review, was very accurate. The extendable whip aerial seemed very effective.

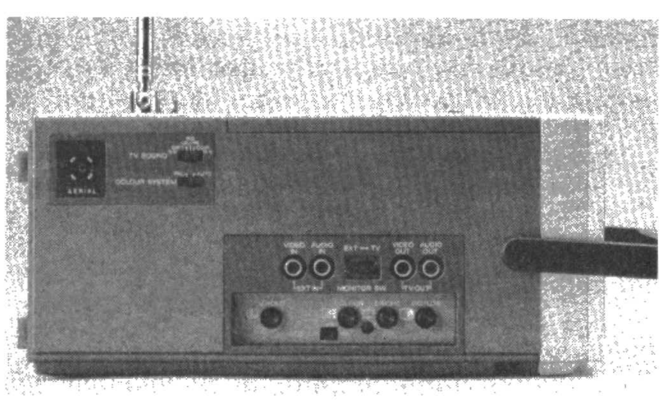
Various preset controls (contrast, brightness, colour, a.f.c. on/off and field hold) are included on the left-hand side along with the audio and video input/output connectors. The latter are of the RCA phono plug type, which unfortunately seems to be becoming something of a standard for domestic video equipment. I know they are cheap and take up little space, but they were never designed for video signals. A small slide switch selects off-air or external signals, the sound and vision being switched simultaneously.

Also on the left-hand side are an external aerial socket (standard 75Ω coaxial), the 5·5/6/6·5MHz sound selector switch, and the colour system switch. The latter has two positions, "auto" in which PAL or Secam operation is automatically selected, and "PAL". The latter is useful in weak signal areas.

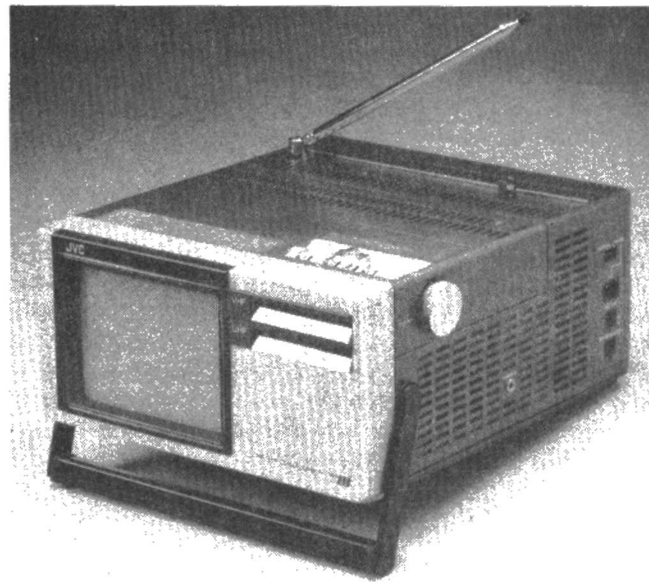
The various power supply sockets are on the right-hand side. The set can be used to charge a rechargeable battery pack, another slide switch giving either "battery recharging" or "set running". For this reason there are two mains on/off switches, one at the back for "all off" and one at the top for "all off except the charger".

Performance

When the set was delivered it gave rather "picture postcard" pictures, i.e. too much contrast and colour. This of course seems to be what the public likes, but for myself I



Side view, showing the TV sound and colour system switching and the audio/video input/output sockets.

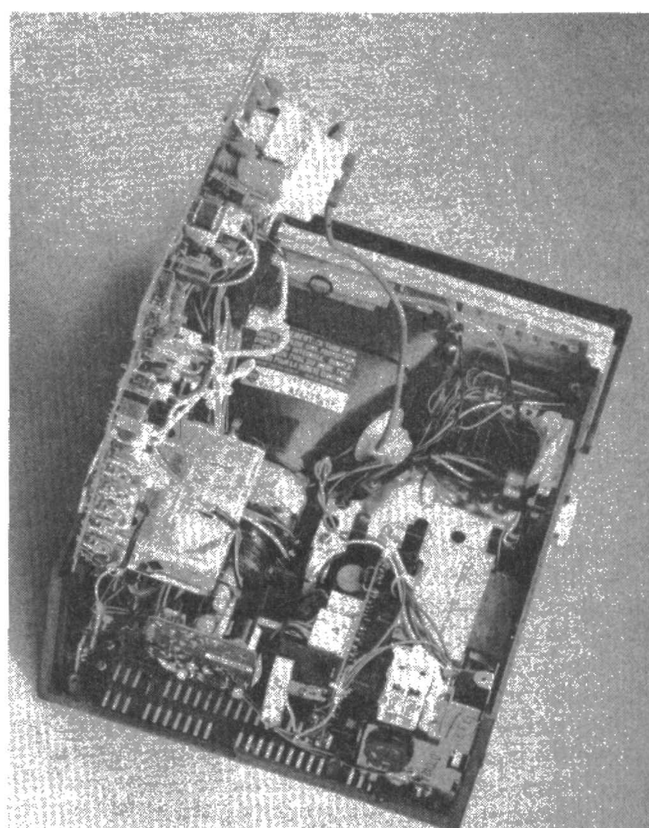


The JVC CX610GB portable receiver/monitor.

prefer to have a colour set correctly adjusted. This was easily done, due in part to the excellent JVC service manual, and the result was a very good picture. My only criticism here is that the pitch of the tube mask is rather noticeable on some scenes.

Tuner performance on both v.h.f. and u.h.f. was found to be better than average, and the a.f.c. was very effective though, as was only to be expected, it tended to swamp weak signals adjacent to a strong local one. In this situation the ability to switch the a.f.c. action off is very useful.

Being based in the north of England I couldn't test the set's off-air performance with a Secam transmission. The



View of the interior, with the main chassis swung out in the service position.

best I could do was to dangle a short length of wire from the r.f. output socket of a Secam test generator near the CX610GB's whip aerial. Under these conditions the set was found to be able to discriminate between PAL and Secam signals adequately, though weak signals could confuse it. System L test signals couldn't be detected of course.

With a video rather than an off-air input, PAL and Secam signals were both well displayed with the auto switching working excellently. The audio and video outputs from the set were clean and recorded well on a dual-standard VCR. Incidentally, when switching between off-air and external inputs with the same signal source applied to both, the impairment of the signal at r.f. was quite evident – so if your set and VCR have video/audio connectors, use them in preference to routing the signals via the u.h.f. modulator.

The Innards

The interior is neatly arranged. A combined u.h.f./v.h.f. tuner drives a conventional i.f. chip via a SAW filter. The demodulated signals are filtered by 5·5, 6 and 6·5MHz ceramic filters to remove/extract the sound component, the latter going to a standard intercarrier sound chip. The signals are then passed to the audio/video input/output board, the outputs being a.c. coupled via suitable switches. The audio signal, either internal or external, is fed to a simple resistive volume control and then to an i.c. audio section driving an 8Ω loudspeaker. There's also an earphone socket.

The video signals are fed to a combined video amplifier/sync separator/pedestal clamp i.c., then pass to separate PAL and Secam decoders. The rest of the RGB and timebase circuitry is conventional.

Summary

In conclusion, the CX610GB is unique in the low-cost, small-set market. In fact if you need a mains/battery portable colour receiver/monitor you don't have much choice! If you add in the multistandard sound and colour facilities however the set is a winner. It's a shame that the battery capability adds so much to the basic price, but probably most users won't find this essential. From the technical point of view the set is well designed and easy to service, though as one would expect with such a small chassis there are a few tricky bits.

All in all however I'd thoroughly recommend the CX610GB. It would seem to set a trend that other manufacturers with domestic video interests will surely follow. ■

While the Blizzards Blew

Les Lawry-Johns

WE'VE had one or two unusual faults of late, also one or two unusual customers. This is not so surprising perhaps, because the world sometimes seems to be populated by weird people. I have a message for you from one of them. "Repent now. This is the last year. There won't be another Christmas. The year will see a series of disasters unlike any before, culminating in the final catastrophe. You had better be prepared." In view of all this I wondered why he found it so important to have his little Indesit T12SGB portable repaired. He did however, so I tried to oblige.

Loss of Signals

The one concerned is the one with push-buttons at the top rather than a rotary tuner at the side (Model T12LGB). The symptom was that the screen lit up, with a trace of grain to show that the i.f. stages were active, but with no signals. So we turned our attention to the tuner, which seemed to be getting its supply voltage but not much by way of a tuning voltage. At the top push-button panel we found we could get only about 2·5V instead of the 30V expected. The suspect components are on the main panel, and we thought we would find that the TAA550 tuning voltage stabiliser i.c. was leaky. It's fed from a line output stage derived 125V rail via an 18kΩ, 2W resistor (R103), and we were surprised to find that the voltage at the h.t. end of this resistor was also very low.

The relevant circuitry is shown in Fig. 1, and what particularly surprised us was that the supply to the video output stage was correct – 125V across C914. As you'll see, two diodes in series rectify the pulses at the collector of the line output transistor to produce the h.t. supplies for the video output stage and the tuning voltage source (the TAA550). If the video output supply was o.k., why wasn't the supply to the tuning circuit? Then the penny dropped. Not something short-circuit, rather something open-circuit. Like the first diode's reservoir capacitor C911. Slap another 0·1μF capacitor from the cathode of D910 to chassis and back comes the voltage and the ability to tune. An unusual one I thought.

The Next Oddity

The next odd one was a colour set with Baird on the front, though it was actually a Körting 51763. The complaint was severe interference on the picture. This turned out to be sound on vision, the picture being completely clear when the volume was turned down. At first we thought the cause might be vibration, but disconnecting the internal speaker and using an external one left the trouble just the same – and it really was intolerable.

As a next step we checked the 470μF electrolytic that decouples the l.t. supply to the audio output stage. This was o.k., but at last we were on the right lines, since the l.t. voltage was higher than specified – and varied with the

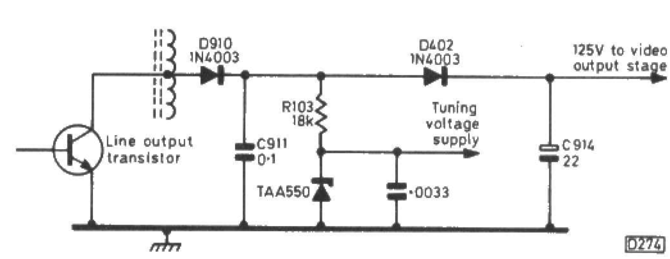


Fig. 1: Method of obtaining the h.t. supplies in the Indesit T12SGB monochrome portable.

volume. The audio circuit is fed from the l.t. bridge rectifier, which also feeds a 24V series regulator circuit. Something must be wrong here we thought, and we proceeded to check the transistors. What we discovered was that the BC178 driver transistor was short-circuit. A replacement restored correct working with an interference free picture – another one we've not had before.

Don's Diagnosis

Don is another of our local characters. Retired now but as lively and cheerful as ever. Except that is on the occasion when his daughter got married. The shock of the expense made him look miserable for a month either side of the event. "You save up all your life to make sure you'll be all right when you retire, and what happens? Your girl gets married and expects a royal wedding. Don't you worry Dad, just sign each cheque in the book and I'll fill in the rest. Murder it is. Extortion. Robbery. I hope the divorce won't cost as much."

"What divorce, Don. Yours?"

"No. Hers. They demand all these posh weddings and six months later they blame you for helping them get married and want your help with the separation. Mad they are. Mad. And we're just as mad."

"Never mind Don. It'll teach you not have girls late in life next time."

"Next time? You mean we've got to go through this again?"

"So they tell me Don. When you die and think you're going to have a nice long sleep, they add up you're score sheet and send you in to bat again."

"Bloody hell. I hope not" said Don mournfully.

But the months passed and Don now seems as cheerful as ever, threatening to sue all and sundry. "Sue you later." "I'll be sueing you." "Sue you in court" and many more in like vein. The other day he came to see us, carrying his Thorn 3500 colour set as though it weighed a few ounces. He exercises with weights each morning you see, which I suppose is why he kept on having daughters until late in life. Maybe if I . . .

My thoughts were cut short by Don's rapid diagnosis of the set's ailment. "It doesn't go Les. Probably a small resistor gone."

"You'll be lucky" I said. "Had one in the other day and it cost the owner a small fortune to put it right. Broke his heart having to spend all that money he'd been saving for his retirement. It looks as if I'll be all right though, with all these sets needing lots of money spent on them."

Don blew on his pipe, and ash scattered all over the place.

"Just have a look Les and see what the time is."

So I took the back off and whilst Don talked to the cat I tried to find out why the chopper wasn't chopping. Now you'll remember the drill. Plenty of h.t. on the body of the chopper transistor, but no 60V supply. 30V supply o.k. So I took the power unit off and turned it up. The chopper transistor read all right, but the diode in series with its

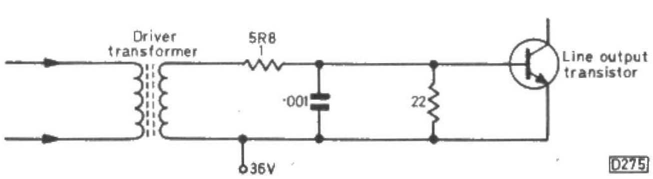


Fig. 2: Line output transistor base drive circuit, Rank T20 chassis. The 36V supply comes from the EW modulator.

emitter was open-circuit (W609 – we didn't show it in our simplified circuit last month). Out came the TRC100P diode and in went a pair of 1N4002 diodes twisted together in parallel. When the unit was refitted the set functioned quite nicely, needing only a few adjustments to make it 100 per cent.

"What was it? I knew it wouldn't be much."

"Just this little thing Don. You were dead right as usual."

"Thanks a million. Better whip it back home. I'll be sueing you."

Don's wife popped in later. "Don forgot to pay you. I don't know what's wrong with him lately. He's not been the same since the wedding."

Resistors

As a matter of fact Don could well have been right in his diagnosis of a faulty resistor, since it seems that every other set that's come in recently has needed a low-value resistor to put it right. For example, at least three Bush sets (T20 chassis) came in during the last week requiring a new line output transistor base current stabilising resistor (5R8, 1Ω) to get them going. The first time this happened we spent a lot of time checking over things before we got to the real cause of the trouble. It went like this.

Set dead except for h.t. at the collector of the line output transistor. Check the driver transistor's collector voltage. High, showing that it's not being driven. Shunt a resistor across the line oscillator start-up capacitor to keep the line oscillator going despite the absence of the line output stage derived 12V line. Voltage at the collector of the driver transistor falls to 125V, thus proving that the line oscillator and driver stages are o.k. Check the EW modulator diodes 5D6/7 because one of them is nearly always at fault under these conditions. This time they were all right, so we made checks on the line output transistor. Surprised to find that the reverse base-emitter resistance is 22Ω, which is high considering that the base and emitter are linked via the secondary winding of the driver transformer and 5R8 (see Fig. 2). 5R8 was open-circuit of course, so that the transistor was receiving no drive. Needless to say, the next one didn't take us nearly so long to find.

As another example, a couple of Thorn sets (9000 chassis) came in with R726 (2·2Ω) in pieces but with no apparent cause. This resistor is in the collector circuit of the diode modulator driver transistor VT702.

'Sno Joke

We've had some pretty cold weather lately, with the cold intense enough to . . . well, you know what. There was a blizzard when friend Ridley popped his head into the shop.

"If we keep burning fossil fuels at this rate Leslie, the greenhouse effect will become so serious we'll all be dying with the heat." So saying he retreated into the snow and fought his way homewards. I went out later to take the dog for his walk. On the way back we had to cross a car park that was a sheet of ice. I slipped and crashed down painfully. It was a few seconds before I was able to scramble back to my unsteady feet. The dog just carried on sniffing, not caring what had befallen me. Two buttons had been torn off the front of my sheep skin, and I managed to find only one of them. I then picked my way painfully homewards to tell Honey Bunch of my misfortune. I'd hardly got the words out when she hit me. "That'll teach you not to fall over and get your coat dirty." Is there no justice at all in this world?

TV Sound Receiver

Part 1

Luke Theodossiou

MOST commercial TV sets are housed in a compact cabinet that precludes the use of a reasonably sized loudspeaker. The result of course is rather poor quality sound reproduction. Another problem is the fact that most high-quality speakers have a strong stray magnetic field which, unless contained or kept well away from the c.r.t., causes havoc with the colour purity. Then there's the question of marketing philosophy: most manufacturers seem to be of the opinion that viewers are not prepared to pay extra for higher quality sound. This is all rather a pity, because the broadcasters take great care to ensure that the f.m. sound channel delivers a very high quality signal.

There are several ways of extracting the audio signal from a TV set. Unfortunately they all suffer from disadvantages of one sort or another. Most sets for example have a live chassis, which means that a transformer or an optocoupler must be used to extract the sound and provide isolation. The former leads to reduced quality, while the latter can be responsible for field pulse pick up, resulting in hum. And neither of these approaches can be used with a rented set.

Our project employs an alternative approach: a separate, self-contained receiver is used for the sound signal. The unit can be made part of the domestic hi-fi system therefore, and does not suffer from interference. Another advantage is the fact that a concert for example can be recorded whilst the TV set itself is tuned to a different station for viewing.

Circuit Description

The complete receiver circuit is shown in Fig. 2. As you can see, the use of up-to-date techniques makes it very simple. A Mullard U321 tuner unit is used since it's available quite cheaply from a number of sources. It's operated at maximum gain by connecting the a.g.c. pin 3 to chassis via a 100Ω resistor (this passes a current of around 10mA, corresponding to minimum attenuation). Operating the tuner in this way is acceptable since in this application we're not concerned with intermodulation products should the aerial signal be excessive.

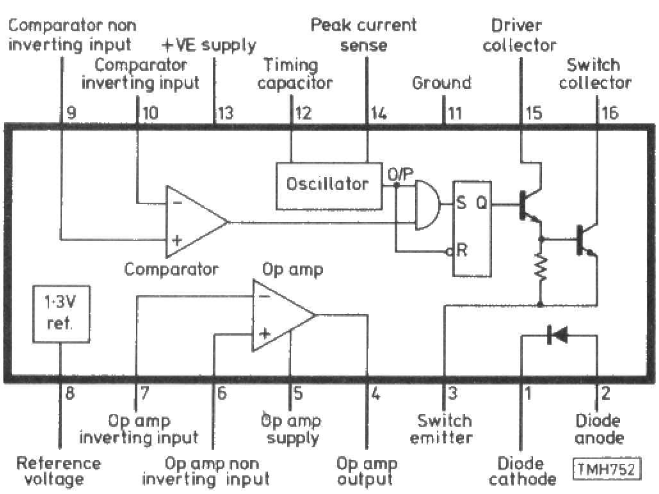


Fig. 1: Block diagram of the 78S40, which can be used as a step-up, step-down or inverting switching regulator as well as a conventional series regulator. It will supply regulated outputs in the range 2·5V-40V at up to 1·5A.

The tuner's i.f. output (pin 10) is fed to a single transistor amplifier which does a bit more than it may appear to do. It enables the 6MHz intercarrier sound signal to be developed by beating together the vision and sound carriers. The following ceramic filter selects the 6MHz signal and feeds it to a standard TBA120U intercarrier sound amplifier/demodulator chip. The audio signal appears at pin 12 and is fed out via C13, C11 providing de-emphasis.

So much for the signals side. The component count has been kept as low as possible to minimize the cost and make construction simple.

Power Supply

The power supply is more interesting than the receiver itself! A conventional mains transformer, bridge rectifier and i.c. voltage stabiliser provide a 12V line to power the receiver. For tuning purposes however a supply of up to 30V is required. Another transformer winding could have been used to provide a supply of some 60V to apply to a standard TAA550 33V stabiliser i.c. This approach would have been straightforward, but would have required a non-standard transformer. Instead, we've adopted a rather more elegant approach: a switching regulator is used in a step-up arrangement to provide a stabilised 30V supply from the 12V rail.

The heart of the switching regulator is the 78S40 i.c. (IC3) – a block diagram of this device is shown in Fig. 1. It consists of a current-controlled oscillator; a temperature-compensated voltage reference; a high-gain differential comparator; a power switching circuit; and a high-gain amplifier which we're not using in our particular application.

The 1·3V reference voltage at pin 8 is fed to the non-inverting input of the comparator (pin 9). R8 and R6 sample the output, applying 1·3V to pin 10 when the output voltage at pin 1 is 30V. Any rise or fall in the output voltage alters the duty cycle of the switching waveform, via the action of the comparator, thus maintaining the output at 30V.

The capacitor connected to pin 12 determines the oscillator's "of" time: the ratio of the off and on times is determined by the step-up requirements, and is roughly equal to:

$$\frac{t_{on}}{t_{off}} = \frac{V_{out} - V_{in}}{V_{in}} = 1{\cdot}5.$$

This enables the oscillator frequency to be determined – in our case the frequency is around 26kHz.

The resistor between pin 14 and the 12V rail determines the maximum peak switching current. The value of 1Ω limits this to 330mA. The energy stored in the

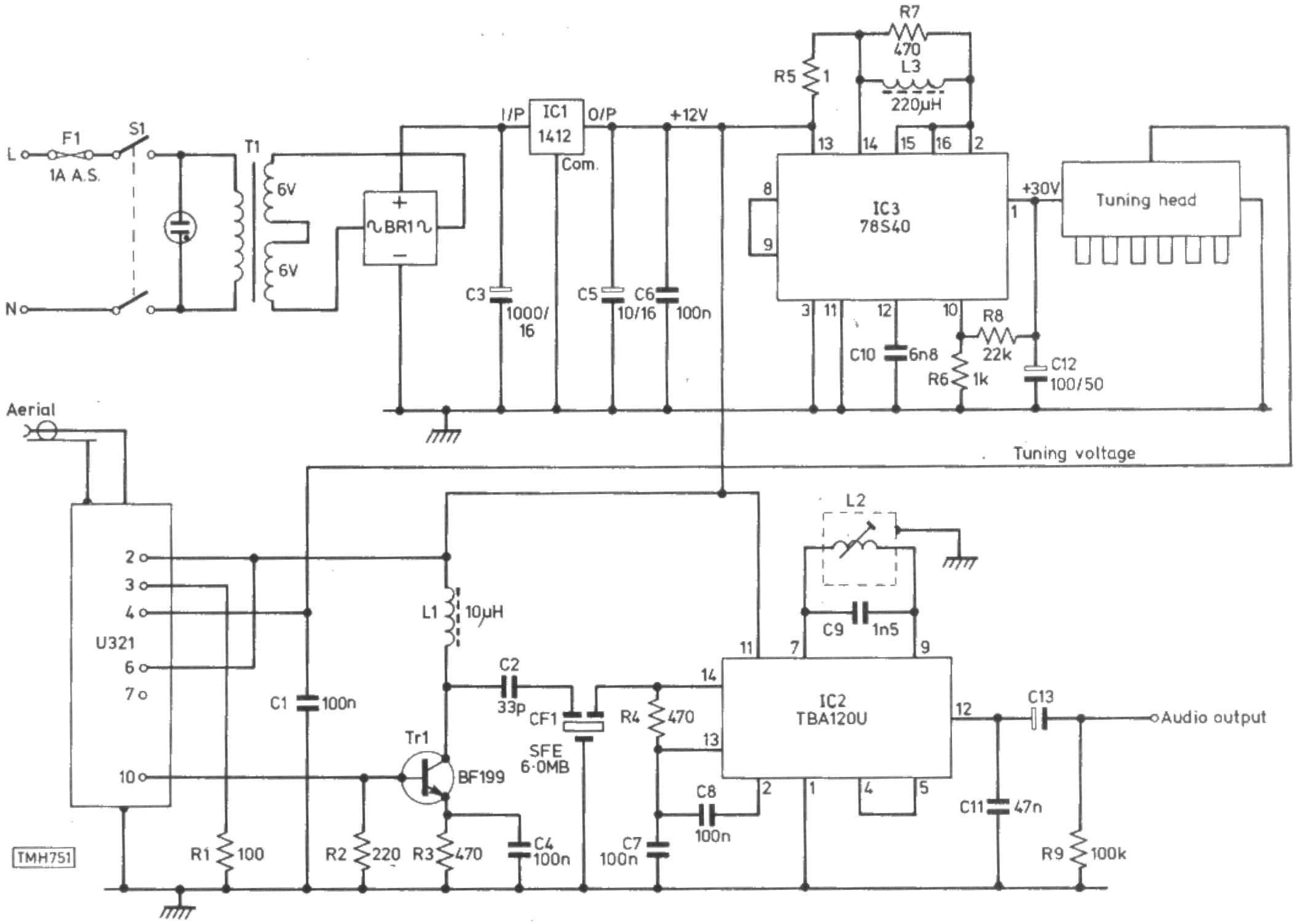


Fig. 2: Complete circuit of the TV sound receiver, with the power supply at the top and the tuner/intercarrier i.f. section below. IC1 is mounted on a heatsink. For the value of C13 see components list below.

inductor (L3) is switched by the two output transistors, which are connected in a Darlington configuration, the resultant peak voltage excursion being added to the 12V pedestal. The damping resistor R7 is included to prevent ringing and instability. The output is rectified by the diode (between pins 1 and 2) inside the i.c., charging the reservoir capacitor C12 to 30V.

This solution to the problem of obtaining a stabilised 30V supply is a simple one using few components. You could of course omit this bit and obtain the 30V supply in a different way, say by winding your own transformer with a high-voltage winding. Our PCB has been designed for the switching regulator however.

To Follow

Constructional and setting up notes and board details will be given next month.

★ Components list

Resistors:

R1	100Ω
R2	220Ω
R3	470Ω
R4	470Ω
R5	1Ω
R6	1kΩ
R7	470Ω
R8	22kΩ
R9	100kΩ

All ¼W, 5% carbon film

Semiconductors:

BR1	RS 262-141
Tr1	BF199
IC1	TDA1412
IC2	TBA120U
IC3	78S40

Wound components:

L1	10μH RS 228-141
L2	6MHz detector coil. Philips part no 4822 156 20737
L3	220μH RS 228-185
T1	RS 207-740

Capacitors:

C1	0·1	ceramic plate
C2	33p	ceramic plate
C3	1,000	16V radial electrolytic
C4	0·1	ceramic plate
C5	10	16V radial electrolytic
C6	0·1	ceramic plate
C7	0·1	ceramic plate
C8	0·1	ceramic plate
C9	0·0015	polystyrene
C10	0·0068	polystyrene
C11	0·047	polyester
C12	100	50V radial electrolytic
C13	2·2	50V radial electrolytic

Miscellaneous:

Tuner	Mullard U321
CF1	SFE6·0MB
F1	1A anti-surge
Neon	RS 576-462
Switch	RS 337-223
Case	RS 508-649

Fuseholder
Push-button channel selector unit
UHF aerial socket
DIN or jack audio output socket
Heatsink (Staver F9-5-126) for IC1

A TV Man's Guide to Video

Part 3

Harold Peters

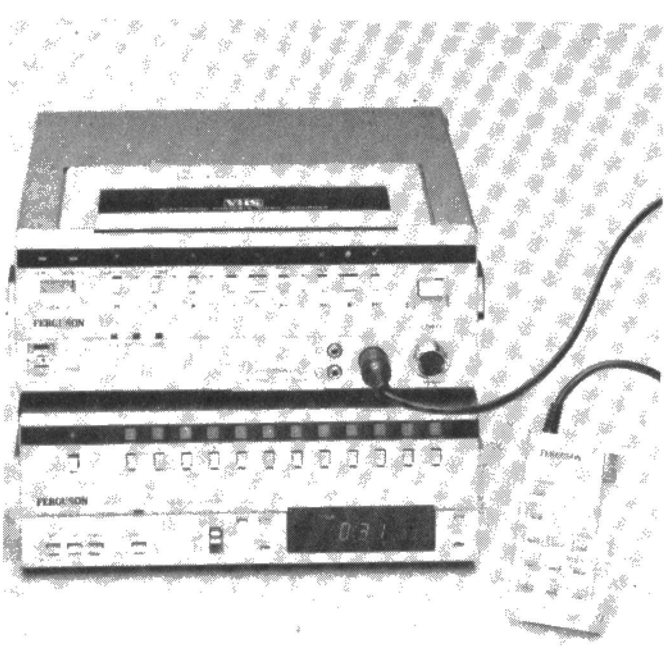
"MAKE your own movies on low-cost reusable tape." This is one of the features plugged by the video camera ads, even if it's usually well down the list. Ads and sales brochures are written by "positive thinkers" however – they never tell you the disadvantages. So before embarking on the final part of this short series the writer decided to experience personally the delights of this side of the subject. Some very clear facts emerged from this foray into the unknown. They can be summarised as "it's easier said than done".

There are two basic types of colour camera available, two ways of getting the signal into the TV set, and two types of video recorder. Thus the permutations of getting it right first time are six to one against. In addition, there's the coming generation of miniature combined camera-recorders. Only equipment generally available at present will be considered here however. One axiom can be stated at the outset: if you are going to make frequent use of a camera with your VCR, plan for it before you begin to buy or hire equipment – get the right outfit from the start.

Portable VCRs

By right outfit we mean the type of VCR specifically designed for camera work, the sort that consists of a "twin set", with a tuner/timer as one half and the recorder as the other. Side by side on the bookshelf they look and behave just like a standard machine, but with a line down the middle. Two leads at the back interconnect them, and if you prefer you can stack them rather than having them side by side – with the recorder section on top.

Inside the recorder half there's a compartment for a nickel-cadmium battery from which the recorder can be operated as a self-contained unit for at least half an hour. When used at home with the tuner/timer unit there's no need for the battery of course – the machine runs from the 12V supply in the tuner/timer. Both halves have their own on/off switch, the one in the recorder being overridden by the one in the timer when you choose to make a timed recording. If you switch the timer part only on, it will charge the recorder's battery (if fitted). LEDs on either half tell you the state of the battery and the charging process.



The current Ferguson "twin set". On top, the 3V24 portable VCR with cable remote control. Beneath, the 3V28 programmable tuner/timer unit which also acts as a mains adaptor and battery charger.

Most timers give only one programme selection per setting, and most recorder units have a corded remote control system. All have a standard ten-way camera socket, and when the camera is connected its output appears on the monitor screen instead of the off-air signal. In this condition it's possible to make recordings within six feet of the outfit, i.e. in the living-room, operating from the mains supply, but the novelty soon wears off. Only portability gives the combination its value, and to make it mobile you simply unplug the recorder half from the tuner half (leave the tuner still connected to the mains to keep the clock going), check that the battery is connected and charged, slip the recorder into its leatherette case, plug in the camera and go off on location, which is where we looked at the cameras themselves.

Camera Features

Colour video cameras are about as expensive as the recorders themselves. All have the following features: (1) A zoom lens, possibly motorised, and a separate focus ring. (2) A built-in microphone, with provision to connect a "boom" mike. (3) Automatic aperture or sensitivity control, with provision to override it in case a too-contrasty background results in a "soot and whitewash" picture. (4) A means of setting the white point, to cater for different types of lighting. (5) A trigger button which starts and stops the recorder.

On cheaper models the viewfinder is optical (through the lens), but most cameras have a 1½in. monochrome c.r.t. which displays the picture actually being recorded, studio fashion. The trouble with these monitors is that there is seldom a control over the brightness and focus, making it difficult to establish with precision the optimum focus when setting up a shot. Some zoom lenses are motorised, freeing some fingers for other work, but they are usually noisy enough to be picked up by an in-built microphone. The viewfinder window gives indications of exposure, battery charge, recorder on/off etc., by means of a bar across the picture or LED indicators just above the monitor screen.

An electronic viewfinder can be used to check your shooting by giving an instant replay, but you must count this time as part of your battery half hour. If you wear glasses, you may find it difficult to focus on the viewfinder, but provision is usually made to lift up the eyepiece for direct viewing.

All cameras take a tripod, and if your photography one includes a pan and tilt head it will be satisfactory. There will possibly be some other knobs and sockets on the camera –

an earphone for monitoring the sound, a lens cover or shutter to prevent tube burns from a strong light when the camera is not in use, and a "macro" facility to enable the camera to be focused on very close objects.

The summary provided so far covers cameras such as those in the Ferguson, Hitachi, JVC and Panasonic ranges. They all use a single colour pick-up tube of about ⅔in. diameter, with a colour striped filter on the faceplate or built in – this works rather like an in-line c.r.t. in reverse.

We also tested the Philips 200 camera, which is the odd man out in many respects. It was developed to provide camera facilities for the 2000 series recorders, which don't have a standard camera socket (and there's no portable version to date). The camera comes complete with a long camera cable in a hose-reel container: the drum of this houses a mains power supply and an r.f. modulator. Although video and audio outputs are provided, the intention is that the camera's output is fed into the recorder's aerial socket, as a u.h.f. signal modulated with the sound and vision. It can be used with any VCR or TV set therefore.

The 200 uses three separate pickup tubes for red, blue and green, and before use has to be "converged". To do this you focus on a test triangle in the lens cover, then press buttons until the three coloured images coincide. This can be a fiddly business unless you're quick to release the buttons, and it's a lot easier if you use the colour TV set instead of the monitor tube in the viewfinder.

Batteries and Chargers

Location time can be extended by plugging a second charged battery into the recorder. This external battery will override the one inside. The idea is to get another half-hour of shooting time by first using the external battery and then disconnecting it to bring the internal one into use. You can recharge the external battery in the same way from the tuner/timer unit – plugging it into the recorder overrides the internal one.

Mains power packs are available for prolonged location work. These charge up one or two batteries or run the recorder from a nearby power point. It's unlikely that you'll need one of these if you have two batteries and a tuner/timer however.

Performance and Use

The single-tube cameras are all very light, but the recorder slung over your shoulder is very heavy. The result is that you feel a bit like Quasimodo, and the pictures turn out wobbly because of the imbalance. The colours are fairly natural if you get the white point right, and the sound is remarkably good and quite sensitive. Sometimes the pick-up tube filter and the shadowmask of the TV monitor screen produce a moiré effect, and as we mentioned before the 1½in. monitor viewfinder is hard on the eye and the zoom motor can be heard on the sound track. Much steadier results and easier working conditions come about by using a tripod.

We played "General Post" with all the twinsets and their cameras. They all worked with each other, but the best results were obtained by using the camera intended for the particular recorder. We didn't try the Philips 200 with the other machines. Though it had a standard ten-pin camera plug, no connection details were provided. So we used it as intended with a Philips VR2020 VCR.

At this point the significance of the performance characteristics waned and the ease of use became of

Hitachi's latest colour video camera, Model VKC600.

paramount importance. With the portables, you can start and stop the recording, zoom in and out and focus up with one hand around the lens and the other on the camera's pistol grip. The recorders backspace every time you pause while shooting, providing a jump-free change of shot. You have full control over your camerawork in fact.

The 200 on the other hand was restricted to the length of its lead from the recorder, and because of the r.f. feed could not start the recorder from the pistol grip. Being top heavy, it was hard to hold. We tried using an infra-red remote control to start and stop the recorder, but it didn't help much because you had to put the camera down to use it. Shot changes produced a tracking "glitch", and the results were scrappy by comparison.

Much the same problems were encountered when we tried to use one of the other cameras with a standard machine linked to the living room TV set.

To summarise then. Using a camera with a portable recorder is the most satisfactory arrangement, and best results are obtained with the camera that goes with the machine. There are so many limitations to using a camera with a machine in the living room that this arrangement is hardly worth while. It pays to start out with the right equipment every time.

Before you start, you might like to find a dealer who hires a camera and portable recorder to his own customers who have standard models of the same make. In this way you can find out whether video recording is for you or if it would be better to stick to Super-8 film. Not everyone can manage all the controls, but if you like movie making and your family cooperate, it can be fun.

TV men might be wondering why most of what's been said above is aimed at the user rather than the dealer or engineer. The problems of camera use are met by the user however, the average engineer seldom getting around to try one out. So this is the angle we've tried to cover.

The current situation is not ideal, and changes occur all the time. The compact cassette system, with a combined camera-recorder, is coming on the market and may more closely approach the cine ideal of loading a cartridge and pressing a button. The 2000 system has proved that satisfactory pictures can be recorded on a ¼in. tape width, and technically there could well be changes during the next couple of years in all formats. On the other hand the existing heavy investment in the present systems may ensure market stability for a time. In the video world it's hard to prophesy. ■

Monochrome Portable Blanking Circuits

George Wilding

ONE of the most important factors in successful and rapid servicing is to make the minimum number of component disconnections for test purposes. Often a little extra thought or one or more simple tests can make such time consuming action unnecessary. In very few cases is it essential to disconnect a transistor to check its working capability. If voltage checks in a suspect stage aren't conclusive, it's permissible with most small-signal transistors to short together the base and emitter connections and note the effects on the collector and emitter voltages. Before getting too involved however it's as well to consider the circuit carefully.

As an example, take the circuit shown in Fig. 1, the video output stage used in the Sanyo Model TPM2180 – a small-screen combined TV/radio/digital alarm clock fitted with a 2in. 40° c.r.t. It looks conventional enough doesn't it? There's a 12kΩ collector load resistor and two emitter resistors. R209 is shunted by a small-value capacitor (C203, 470pF) to give a boost to the stage's h.f. response, i.e. R209 is decoupled at the higher frequencies but at the lower frequencies introduces negative feedback. R210 enables contrast control to be effected by feedback action: when the slider of VR201 is at one end, C204 decouples R210, but as the circuit resistance of VR201 is increased so the amount of negative feedback is increased and the stage gain decreased. The field flyback blanking transistor Q507 is connected across the emitter circuit resistors.

Consider next the circuit shown in Fig. 2, this time the video output stage used in the Thorn 1613 portable chassis. It looks very similar, doesn't it, though with a few components added – a diode beam limiter circuit (W5 and associated components) and a video d.c. level preset in place of the contrast control. The field flyback blanking transistor VT6 is again connected across the output transistor's emitter resistors.

Now though the two circuits look alike, there's a fundamental difference. The clue to this lies in the flyback blanking transistor voltages. A blanking transistor may be either saturated or cut-off most of the time, being cut-off or saturated when called upon to provide the blanking action. The voltages reveal that Q507 is cut-off most of the time, with 0V at its base: VT6 on the other hand is normally saturated, with 0·8V forward bias at its base and its collector voltage at 0·3V, W4 isolating the blanking stage from the output stage since under these conditions it's reverse biased. What does all this tell us?

When Q507 is saturated by the field flyback blanking pulse at its base, its collector voltage and thus Q203's emitter voltage will fall to a fraction of a volt. This removes Q203's emitter bias. Q203 will also be saturated therefore, its collector voltage in turn falling to a very low figure. So the c.r.t. has a negative-going voltage applied to it to blank out the screen. Clearly the video output transistor drives the tube's grid rather than its cathode. In fact the small tube's cathode is internally connected to one side of the heater, in the interests of long tube life.

The flyback blanking transistor in the Thorn circuit works in the opposite way. When the field flyback blanking pulse arrives it switches VT6 off. The emitter of VT5 is then linked to the 24V rail via W4 and R47. The increased emitter bias switches VT5 off, its collector voltage rising to almost 92V to provide a positive-going pulse to blank out the screen. This implies that, following the normal practice, the video output stage drives the tube's cathode.

W3 and W2 develop a constant 1·2V to stabilise the output transistor's emitter bias, which is adjusted by means of R43. W5 cuts off to provide beam limiting should the video drive be excessive – the voltage at its anode will then fall below the voltage at its cathode, and the video signal

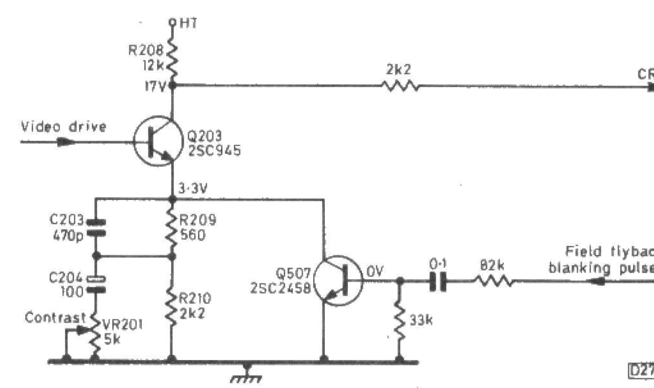


Fig. 1: Video output/field flyback blanking circuit used in the Sanyo TPM2180 combi set.

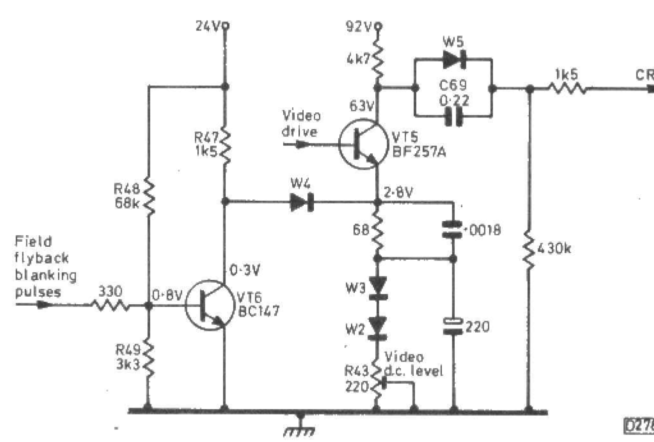


Fig. 2: Video output/field flyback blanking circuit used in the Thorn 1613 chassis.

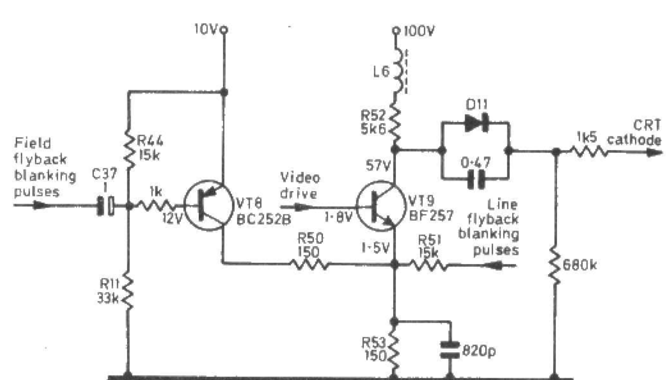


Fig. 3: Video output/flyback blanking circuit used in the Rank T16 chassis.

will be a.c. coupled by C69 instead of being d.c. coupled (since this removes the d.c. component, the drive is reduced).

As both these field flyback blanking transistors are npn types, Q507 requires a positive-going pulse to switch it on while VT6 requires a negative-going pulse to switch it off. From the servicing point of view the interesting point is that the same faults will have opposite symptoms in the two circuits. If Q507 goes open-circuit the only effect will be the loss of the blanking action: if it goes short-circuit, the screen will be blanked out. If VT6 goes open-circuit the screen will be blanked out, while if it goes short-circuit there will be no blanking. Assessing circuit action can thus quickly pinpoint possible causes of fault conditions.

Before taking a look at another blanking circuit, an interesting point about the Sanyo TPM2180 is the fact that it can be switched for 525-line/60-field or 625-line/50-field operation. The timebase switching adjusts the field charging (height) and field hold circuits. There is no switching in the line generator circuit, the flywheel sync circuit apparently being able to cope with the small difference in the two line frequencies (15·750 and 15·625kHz respectively).

The circuit shown in Fig. 3 is used in the Rank Bush Ranger-2 portable (T16 chassis). This employs a pnp transistor (VT8) for field flyback blanking. The transistor is normally biased off, in this case by the positive-going field scan waveform applied to its base via C37. The flyback pulse is negative-going, switching VT8 on. VT9's emitter is then linked to the 10V rail via R50 and VT8, with the result that VT9 is cut off and the c.r.t's cathode is blanked by the resultant positive-going pulse at VT9's collector.

Line flyback blanking is effected in this circuit by connecting the emitter of VT9 to the collector of the line output transistor via R51. The positive-going flyback pulses at the collector of the line output transistor are in the region of 200V peak-to-peak, and are reduced to about 2V, sufficient to cut VT9 off, by the potential divider action of R51 with R53.

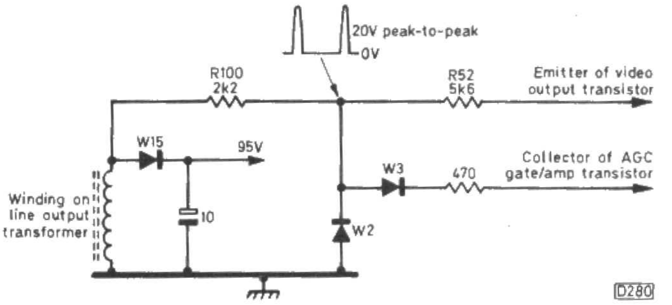


Fig. 4: Method of obtaining the line flyback blanking pulses in the Thorn 1690/1691 chassis.

It's not essential to use a transistor to apply flyback blanking of course, as we've just seen with the line flyback blanking arrangement used in the Bush Ranger-2. What is necessary is to ensure that the amplitude of the blanking pulses is not excessive. Fig. 4 shows the source of the line flyback blanking pulses in the Thorn 1690/1691 chassis – the line output transformer winding that also feeds the 95V supply rectifier. The flyback pulses are reduced in amplitude by the potential divider action of R100 and R52 in conjunction with the video output transistor's emitter circuit resistors, with W2 clipping the negative-going excursions of the pulse waveform at a little above chassis potential. ■

Vintage TV: Cossor 930 Series

Vivian Capel

COSSOR used the same basic TV chassis from 1952 to 1955. The sets we're specifically dealing with this time are Models 930, 931, 933 and 934. They were fitted with 14 and 17in. tubes, and came in table and console presentations. Earlier models were fitted with 12in. tubes, while later ones had a turret tuner for dual-band operation and different i.f.s.

The appearance of the console models was clean and uncluttered, with a gently sloping upper half containing the screen and a bevelled top edge. Below this there was a plain rectangular speaker grille with a bevelled lower edge to the aperture. The bottom few inches of the cabinet below the grille sloped inwards, and the controls were hidden in a recessed panel at the right-hand side.

Sound Quality

The cabinet was deep as well as wide, and this together with the 8in. speaker resulted in excellent sound reproduction. This despite the fact that the audio circuit was nothing exceptional, with just a single output pentode (16A5/PL82) fed from the detector/interference limiter circuits. I well remember that one of the pieces played every morning during the test card transmission in those days was Verdi's "Forces of Destiny" overture. This would sound superb in our rather bare workshop if a 930 happened to be in for service. The rated power output was just 1·75W, which seems low by modern standards: it only goes to show that with a goodly-sized, sensitive speaker and a large enclosure, high output powers are hardly necessary.

Implosion Screen

The glass implosion shield was fixed neither to the cabinet nor to the tube mask, being held in place by pressure between the mask and the cabinet. This could cause problems. On one occasion a new engineer was asked to remove the tube assembly from one of these sets. He did so with the console standing upright on the floor, and as he withdrew the assembly there was an almighty crash from within the cabinet. The hapless engineer stood there surveying the fragments of broken glass at the bottom of the cabinet while holding the tube in his arms. The assembly should have been removed with the cabinet placed face downwards, but there was no mention of this in the service sheets. It's surprising how much useless information could be provided whilst an important point like this was missed out!

RF Unit

A feature of these sets was the detachable r.f. subchassis, which was mounted beneath the main chassis, between the side supports. It could be removed by taking out a self-

tapping screw at each side, then sliding it out to the extent of the video lead – the latter was then simply unplugged. To complete the removal of the subchassis, the interconnecting octal plug was disconnected from the main chassis. This arrangement made it easy to service the r.f. unit or to swap over subchassis in the case of an obscure fault. One effect that was sometimes present was patterning over the whole screen: the cause was simple – the self-tapping screws were loose, affecting the earthing between the unit and the main chassis.

The r.f. circuit was fairly conventional – a pentode amplifier followed by a pentode frequency changer. The five Band I channels were selected by individually tuning the input and anode coils in the r.f. stage and the oscillator coil in the frequency changer stage, though some models were fitted with what Cossor called a "mono tuner" which enabled the three cores to be adjusted simultaneously by a single control at the rear of the subchassis. A built-in 30dB attenuator could be selected for reception in high signal-level areas.

The contrast control varied the cathode bias applied to the r.f. amplifier and first vision i.f. amplifier valves. Fringe versions were produced – identified by the addition of the suffix F to the model number. There was no increase in the r.f. gain with these sets: the differences consisted of changes to the vision interference limiter circuit, alterations to the

values of the video output pentode's cathode components, and the addition of bias stabilisation in this stage (a 47kΩ resistor from the cathode to the h.t. line). All sets used d.c. coupling between the video amplifier and the cathode of the c.r.t.

The signal was coupled from the r.f. amplifier's anode coil to the control grid of the frequency changer by means of a 100pF capacitor. The oscillator coil was connected in the frequency changer valve's screen grid circuit (see Fig. 1), and there appeared to be no feedback path to produce oscillation. In fact feedback was obtained via the valve's screen grid-to-control grid capacitance. One or two other manufacturers, including Decca and Plessey, used this technique. It was not very common however, and tended to cause some head scratching when fault finding in this area. The vision i.f. was 13·6MHz and the sound i.f. 10·1MHz. The vision and sound i.f. channels were separate, with two stages each, the sound channel incorporating a.g.c. which partly compensated for the variation of r.f. gain when the contrast control setting was changed. All the pentodes on the subchassis were of the 6BX6 (EF80) type, while the two twin diodes were of the 6AL5 (EB91) type. A single germanium diode was used, as the vision interference limiter.

Timebases

In the timebases, liberal use was made of a valve that was to become very popular with setmakers, the 6AB8 (ECL80). In the early fifties there were few multi-section valves apart from diode-triodes, double-triodes, and triode-hexodes that had internal coupling between the sections for use as frequency changers in radio receivers: a triode-pentode with almost independent sections opened up many possibilities for economy. There was still the limitation of the common cathode, but for many applications this was not a drawback.

There were three 6AB8s in all. The pentode section of the first was used as the sync separator, removal of the video information being effected by operating it with a low screen grid voltage (10V) – this was obtained from the cathode of the field output pentode. Two of the triode sections were used as a cross-coupled multivibrator in the field generator circuit. A second germanium diode put in an appearance here, as an interlace diode. The second pentode section was used as the field output valve, and the final 6AB8 was used as a cathode-coupled multivibrator to generate the line drive waveform. The field output stage used an autotransformer with a tap to feed the field scan coils. The latter carried h.t. therefore.

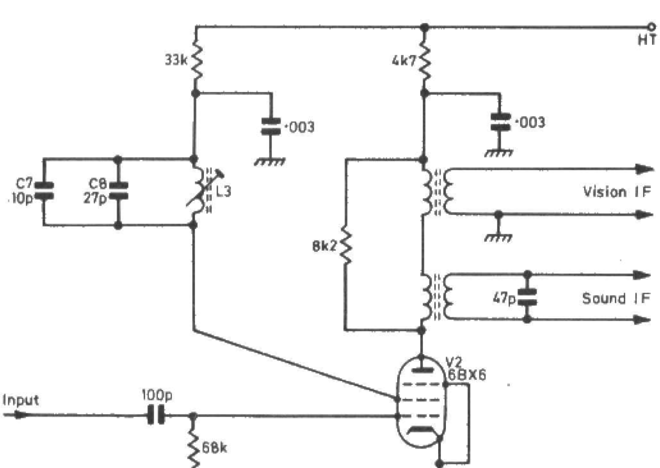


Fig. 1: The frequency changer stage used in the Cossor 930 series. L3 is the oscillator coil, with feedback via the valve's interelectrode capacitance. C7 and C8 had negative and positive temperature coefficients respectively.

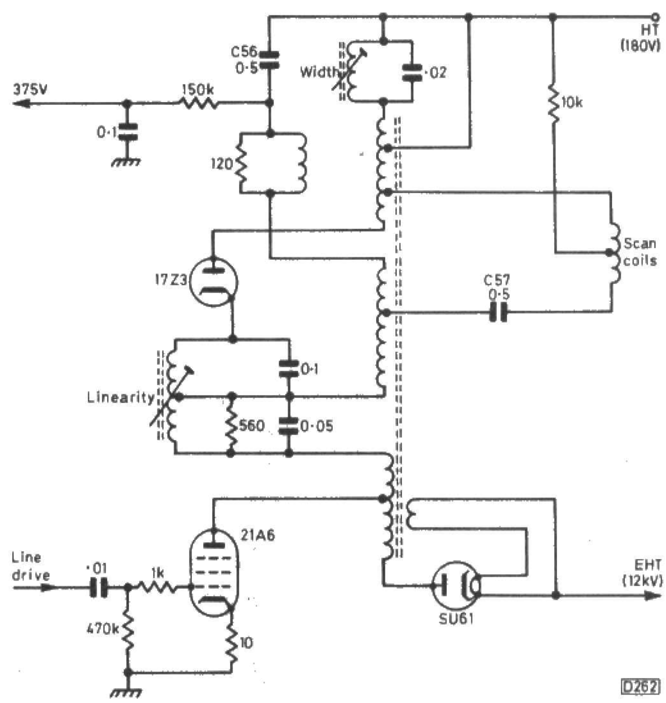


Fig. 2: The line output stage circuit, with balanced drive to the scan coils from two secondary sections on the line output transformer. The coupling capacitor C57 provides a d.c. block. The line output valve's screen grid feed has been omitted to simplify the circuit.

The line output stage (see Fig. 2) used the conventional output pentode/boost diode/e.h.t. overwinding plus rectifier configuration, but the transformer was one of the more elaborate ones of the period. Cossor saw fit to use a split secondary winding to drive the line scan coils, providing a balanced output to prevent interaction between the line and field coils on the defection yoke. A boost voltage of 375V was produced across the reservoir capacitor C56: it was used to supply the tube's first anode and the field charging circuit. The linearity coil was connected in the primary circuit to control the voltage conditions here, rather than being in the secondary circuit, i.e. in series with the scan coils. This arrangement was quite common at the time, before the saturable reactor type of linearity coil came into common use. The width control was rather unusual, providing adjustable damping across one of the secondary windings on the transformer.

HT Supply

Two 19Y3 (PY82) rectifiers were connected in parallel to provide the h.t. supply, with a 50Ω surge limiting resistor in series with each. It was often found that one of the rectifiers would be running very hot and the other cool, due to one of the surge limiter resistors going open-circuit.

Field Flyback Blanking

During the production run of the 930 series field flyback blanking was added, the grid of the c.r.t. being taken to the grid of one of the triodes in the field multivibrator circuit via an 0·1µF capacitor and a 100kΩ resistor, with a 470kΩ resistor included in series with the wiper of the brightness control to isolate it from the field generator.

Practical TV Servicing: Testing with a Neon

S. Simon

SOMETHING happened the other day to prompt this article: we'd been called out to repair a set only to find that our multimeter was completely out of action when it was asked to perform. Since we'd lent it to a relative and hadn't checked it when it was returned, this wasn't quite the shock it might have been. The fact was however that we were without a meter and still had to make a diagnosis.

Simple Neon Checks

Luckily the set was a Philips G8, which is a particularly easy set to service. So out with the neon screwdriver which we knew to be working. Our first check was at the left-hand side 3·15A mains fuse. The neon lit, so there was a.c. at this point (see Fig. 1). We then checked for neon glow at the two left-hand side h.t. fuses – on the printed panel part of the power supply unit. No glow here, so no h.t. Our next check was at the front end of the dropper resistor assembly: a good glow was obtained at the two lower tags, i.e. at both sides of the 2·2Ω surge limiter resistor R1367 in the a.c. feed to the anode of the BT106 mains rectifier/regulator thyristor, but a glow could be obtained at only one of the two upper tags, i.e. at only one side of the 68Ω h.t. filter resistor R1381. This suggested that the thyristor was charging its reservoir capacitor C1385, but that the h.t. supply thus produced wasn't reaching the h.t. fuses – due to the top section (R1381) of the dropper resistor assembly being open-circuit.

Carrying out the Repair

Now see if you can remember what we said in an earlier article on this subject. What's the next move? To replace the dropper? No. To discharge the reservoir capacitor? Yes. This is most important for your good health. The idea is not to stick a screwdriver blade from the capacitor's live tag to chassis either. Switch the set off and note that the live tag continues to produce a glow, indicating that the capacitor still carries a heavy charge. Next take a resistor of about 1kΩ or so and bridge it across the two tags of the capacitor: hold it there for a few seconds, then check again with the neon to prove that the resistor has done its job and that both tags of the capacitor are now dead. You can then proceed to replace the dropper, which all engineers carry with them when called to service a G8 – they also carry 3·15A anti-surge fuses, 800mA fuses (both anti-surge and quick-blow), a BT106 thyristor, a 47Ω wirewound resistor (R5535, the anti-breathing resistor in the h.t. feed to the line output stage), and a line output transformer. They may carry other things as prudence directs, but these are the basic essentials.

On this occasion we were lucky: a straightforward job with no complications. But let's dally a while on this neon testing, and refresh our memories a little.

Other Possibilities

Say for example that the neon had lit at both the upper tags on the dropper, i.e. at both sides of R1381. This would have meant that h.t. was present at one end at least of the two h.t. fuses, so the next move would have been to check that they are both intact. They probably would be. But since the set doesn't work (apart from the c.r.t. heaters glowing) what next?

Next check the 800mA fuse on the right-hand side line scan panel. You should get a neon glow at each side but the chances are you won't. If you do, move on to the front end 47Ω wirewound resistor R5535 which you can see sticking out with your little torch shining on its blackness (sometimes green). Check that there's h.t. at both ends. If there isn't you've found the culprit. If there is you're in a spot of trouble without a multimeter, because the probable situation is that the line output stage is receiving its h.t. supply but is not being driven by the driver stage. The latter in turn may not be receiving an input from the preceding "trigger amplifier" stage, which may not be getting an input from the line oscillator. Several suspect stages therefore. The first thing to check is that the 10kΩ line oscillator start-up resistor R4516 on the lower right-hand side timebase panel is intact (it's near the transductor, on the right-hand side of the panel, approximately half way up). Then check the trigger amplifier's 8·2kΩ collector load resistor R5515 on the line scan panel (it's near the 47Ω resistor). Remember these points: they may save you a lot of trouble some time.

Suppose instead that the 800mA fuse on the line scan panel is not intact. Do you replace it? Not right away, unless you have lots of fuses in your case: the chances are that it would blow again straight away. Instead, remove the screening (two screws to be slackened) over the line output transformer. Then take off the cap which feeds the tripler from a nipple on the top of the transformer. You can then risk another fuse, for two reasons. Obviously to see whether it still blows with the tripler disconnected: less obviously to see whether there's a spark in the transformer winding, denoting where the real fault lies.

Neon Operation

All this presupposes that the fault you have been called to is "no results" – the set completely inactive apart perhaps from the tube heaters glowing. The primary role of the neon screwdriver is to let you know where there are voltages capable of making it glow. The usual type of neon screwdriver has a spring, a 1MΩ resistor and a neon which will glow if there is a potential difference between the contact blade and something

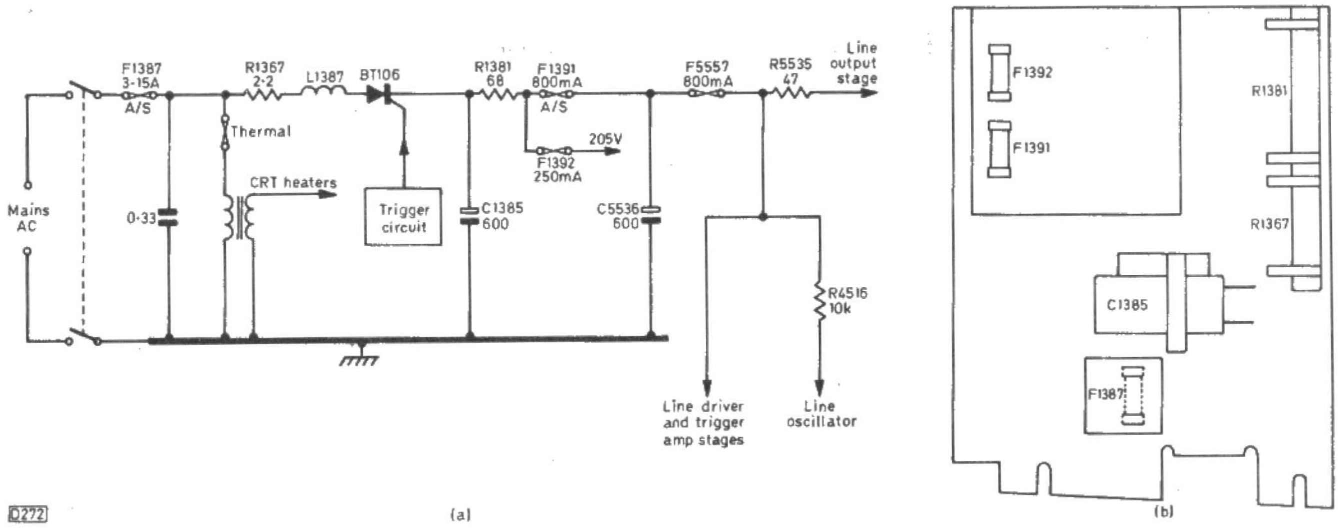


Fig. 1: Mains power supply arrangements (simplified circuit) used in the Philips G8 chassis (a). Positions of the fuses and dropper resistor sections on the power supply panel (b). Components suffixed "1" are on the power supply panel, those suffixed "5" are on the line scan panel, while R4516 is on the timebase panel.

else (normally you, completing the circuit to earth). A better glow is obtained if your free hand touches a low potential point, say the receiver's chassis, which is generally connected to the neutral side of the mains supply, thus providing a better circuit than relying upon the stray contact to earth. We must hasten to add however that the receiver's chassis cannot be relied upon to be at mains neutral. Indeed on very many sets, where there's a bridge rectifier in the mains input circuit, the chassis will be at half mains potential irrespective of the polarity of the connections to the mains plug. Even in older sets the mains wiring or the plug connections may have been transposed, so that the chassis is connected to the live side of the mains supply.

Check the Chassis

This is why the first test you should always make is to apply the neon screwdriver to the set's metalwork, to see if it's live. Whilst more modern sets with a mains bridge rectifier may be designed to have a "floating" chassis, i.e. chassis metalwork that's not connected to mains neutral, a neon glow from the metalwork of an older model should immediately give cause for concern – because one of the first things one does once the back has been removed is to refit the aerial plug which is in one hand, and the chances are that the other hand will be used to steady the chassis, resulting in an unpleasant shock since all outside aerials are earthed.

Having observed these precautions you may still be fooled by the fact that although the mains plug is correctly wired, with no joins in the lead, the chassis may still make the neon glow. This could be the reason why the set is not working: the live side of the mains supply could be in order, but the chances are that there's no return to neutral, either because of a fracture in the mains lead or a faulty on/of switch (neutral side only), or possibly an open-circuit between the switch and chassis.

Checking Tube Base Voltages

Now what else can you check with your neon? Bearing in mind its limitations, i.e. the fact that it requires something over 150V to give a reliable glow, a rough idea of tube base voltages can be obtained if one is aware of the pin connections. A bright glow should be obtained at the first anode(s), where the voltage is usually 400V or more, and a less intense glow (aided by a hand on the chassis) at the cathode(s). This check on the first anode(s) will not only prove the presence of a supply but also the fact that the line timebase, from which it's derived, is working – supposing that the fault is a blank screen. A back of the hand test at the front of the screen is a rough check on whether the e.h.t. is being applied to the c.r.t.'s final anode, i.e. the hairs should rise!

Thus a couple of examples of how to do without a multimeter if needs be.

No Contact Tests

One of the happy habits of a neon is that it will light up if brought near a high-energy source such as a working line output valve, efficiency diode or a line output transformer. We can thus obtain a good idea of the working efficiency of this key section of a TV set without touching anything! Indeed we should add that the demise of a good neon can be assured by letting it touch such a source – and if you are holding it this won't do you much good either since the 1MΩ limiting resistor is a low value in the face of such a high pulse potential. So it's as well to use a neon (or anything else) with caution in an area of such high radiating potential.

Tripler Check

Continuing with this theme, we can roughly check a suspect tripler because if the neon doesn't light when brought near the line output transformer but does when the tripler (or e.h.t. stick if a tripler is not employed) has been disconnected the conclusion must be that this item is overloading the transformer – or is itself being overloaded by a faulty tube or e.h.t. reservoir capacitor in those few cases (some monochrome portables or really vintage stuff) where such a capacitor is used. The tube could of course be without bias and thus drawing excessive current because the supply voltage to the video amplifier(s) is absent. However, you get the drift.

A neon screwdriver is a handy tool to carry with you whether the multimeter is available or not.

Microcomputer Clock-Timer

Part 3

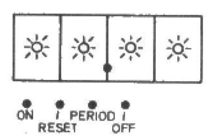
Luke Theodossiou

THIS final instalment provides detailed instructions on how to set up the clock-timer, starting with the clock itself. The "everyday" button doubles up as the 'O' button.

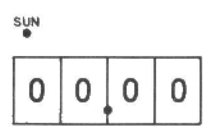
Setting the Clock (e.g. set for Tuesday, 8.45)

On applying power, the display flashes 8s and the on, off, period and reset LEDs are illuminated. Depressing the clock button sets the timer at Sunday 00.00. Depressing the day button starts all seven day LEDs flashing. The clock is next set to the correct day and time. When the clock button is again depressed, the clock will start to count – this is indicated by the colon flashing. The procedure, assuming that it is Tuesday, 8.45, is as follows:

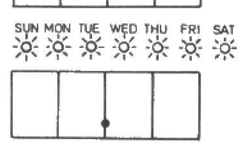
Apply power



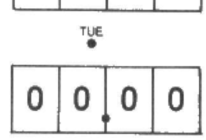
Press clock button



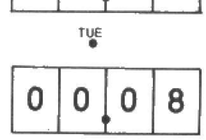
Press day button



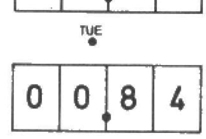
Press the Tuesday button



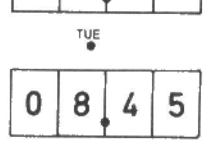
Press button 8



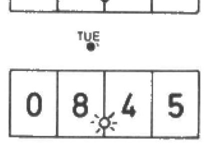
Press button 4



Press button 5



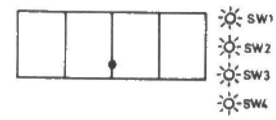
Press the clock button again.



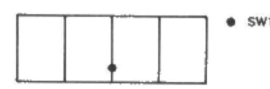
Setting the Switching Times (e.g. set switch 1 ON for Wednesday, 6.30)

The timer's four switches can be controlled either by settings which are stored in the memory, or by manual instructions. Each switch can be switched on/off up to 28 times weekly (memory control), with four on/off operations each day. The procedure for setting, assuming that we want switch 1 to switch on at 6.30 on Monday, is to press the buttons in the following sequence:

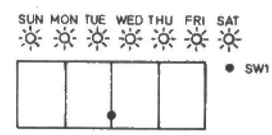
Switch



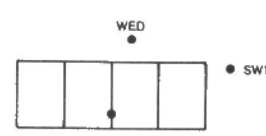
1



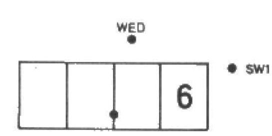
Day



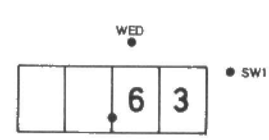
Wednesday



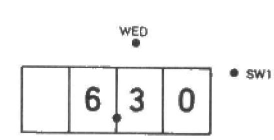
6



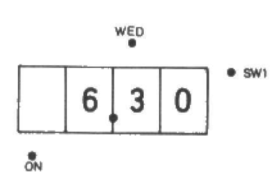
3



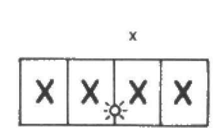
0



ON

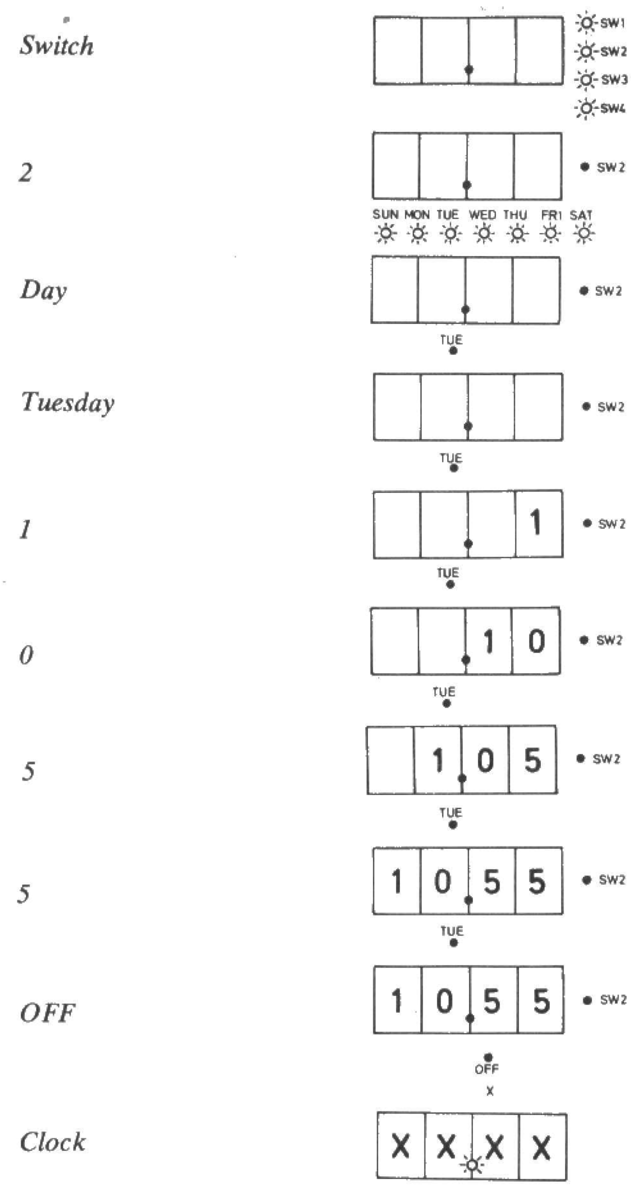


Clock



To turn a switch off, follow the same sequence but press off instead of on. For example, to set switch 2 for

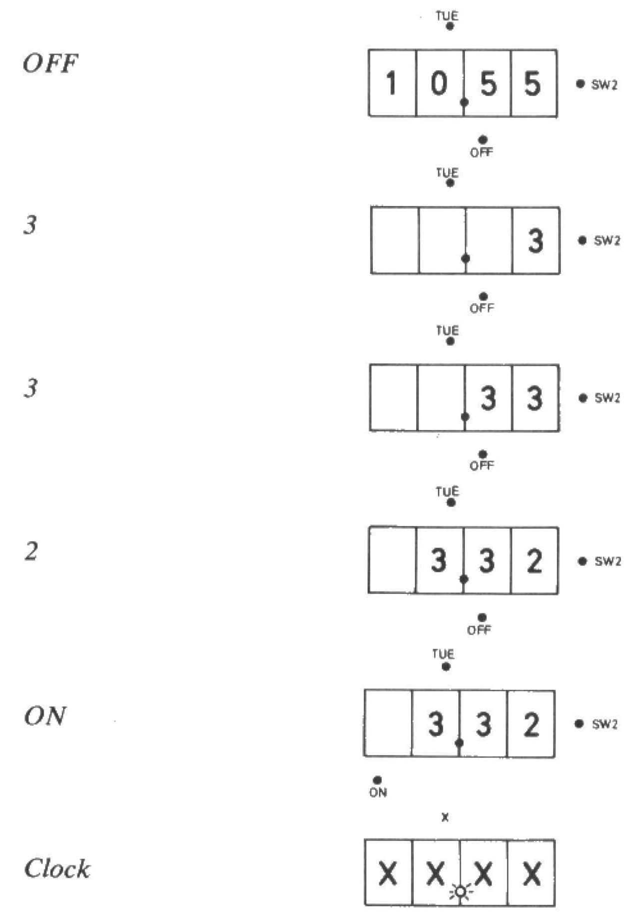
off on Tuesday at 10.55, operate switches as follows:



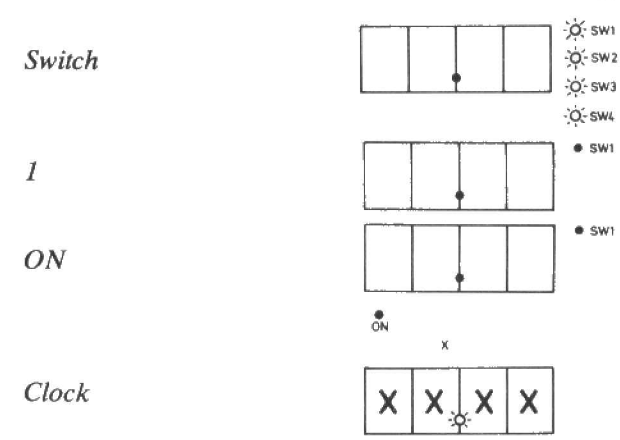
Multiple entries for one switch on the same day (e.g. also turn switch 2 ON on Tuesday at 3.32)

Enter the first setting as described above, but do not revert back to the clock display. Enter the next setting time followed by ON or OFF.

This process may continue until all the required settings have been entered or all of the memory has been filled. When entering switching times for the same day in the following week, it may be necessary to safeguard against inadvertent switching of the output(s) on the current day. To avoid this, enter the switching times working backwards from the actual clock time to 00.00 hours on that day only. Switching times for that day beyond actual time (and for all other days) may be entered in any order, but it is advisable to programme the timer sequentially, particularly when using period settings. In normal use, during the period from 00.00 to 00.01, the display will flash or blank while the switching times in the memory are arranged for the following day – except during the transition between Saturday and Sunday, when it remains unaltered. This sounds very complicated, but if followed to the letter when actually programming the timer, it will be realised that it is in fact quite logical and each sequence is easily remembered and readily repeated. The following procedure illustrates the above example. From the previous OFF operation:



Direct ON and OFF (e.g. to turn switch 1 ON directly)



Using "Everyday" button:

If it is required that a switch operates at the same time everyday, use the "everyday" button instead of a specific day button. This will result in all "day" LEDs being illuminated. The procedure is identical to the usual switch-setting one in all other respects.

Period setting (e.g. turn switch 3 ON at 1.00 Monday for a period of 4 hours)

This is an alternative way of entering OFF times. It must be entered directly after an ON entry when the desired ON period has been entered. On pressing the PERIOD button, the correct OFF time is displayed and stored in the memory. The maximum period length is 23

hours 59 minutes. Initially the timer is in the clock mode.

Switch	blank; SW1 SW2 SW3 SW4 flashing
3	blank; • SW3
Day	SUN MON TUE WED THU FRI SAT flashing; blank; • SW3
Monday	MON •; blank; • SW3
1	MON •; 1; • SW3
0	MON •; 1 0; • SW3
0	MON •; 1.0 0; • SW3
ON	• ON; MON •; 1.0 0; • SW3
4	• ON; MON •; 4; • SW3
0	• ON; MON •; .4 0; • SW3
0	• ON; MON •; 4.0 0; • SW3
PERIOD	• PERIOD; 5.0 0; • SW3

Reset Setting (e.g. Set reset time to Tuesday 9.40)

Using the RESET setting puts the unit into the timer mode where it will run up to the reset time then either automatically reset to Sunday 00.00 and commence counting again, or wait for a start input, depending on the selected mode. A reset time from Sunday 00.01 to Saturday 23.59 may be programmed, allowing a "looping" period from 1 minute up to 7 days in which all the switches may be used. When a looping period is required enter the reset point to give the required loop length. Set the clock to Sunday 00.00 and start the clock when the period is required to commence. The reset mode is set with the reset/continuous toggle switch. Initially the unit is in the clock mode.

Reset	blank
Day	SUN MON TUE WED THU FRI SAT flashing; blank
Tuesday	TUE •; blank
9	TUE •; 9
4	TUE •; .9 4
0	TUE •; 9.4 0
Reset	TUE •; 9.4 0
Clock	x; X X.X X; • RESET

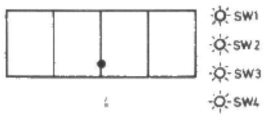
The clock will run until Tuesday 9.40 when it will reset. If continuous reset is selected it will automatically reset to Sunday 00.00 and start counting again. If non-continuous reset is selected it will reset to Sunday 00.00 with the display flashing up zeros and wait until a start command is given. On pressing the start button the clock will commence counting from Sunday 00.00 until the reset point is reached again.

Memory display (e.g. display the memory contents of switch 2)

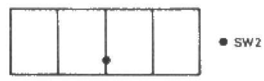
To display the memory contents of any of the switches it is necessary to enter into the specific switch mode. Its contents can then be viewed chronologically from Sunday to Saturday by depressing the switch select button. The contents are displayed numerically on every *double* depression with the single day entries followed

by the everyday ones. If no single day entries are present the everyday entries will be shown first. If there are no entries at all, the display will show 88.88 and all the day LEDs will be illuminated.

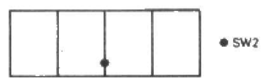
Switch



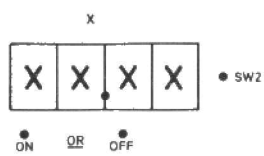
2



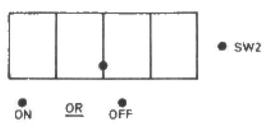
Switch



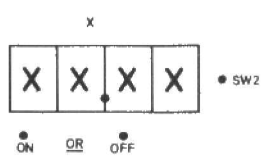
Switch



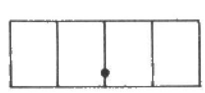
Switch



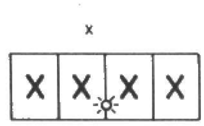
Switch etc



Clear



Clock



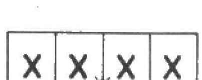
Clear all memory

Pressing the MEMORY CLEAR button *twice* clears all the switch ON and OFF times stored in the system memory.

Memory Clear

Memory Clear

Clock



Clear Clock

This operation clears the clock setting, allowing a new day and time to be entered. It is achieved by a single CLEAR command when the unit is in the clock mode. The DAY button followed by the required actual day and then time are entered in the same way as setting the clock.

Display of reset time

To display the reset time, enter the RESET command *twice* when the unit is initially in the clock mode. The reset time and day will then be displayed. To revert to the clock press the CLOCK button once.

Clear reset time

With the timer in the clock mode the reset time may be deleted by keying RESET followed by MEMORY CLEAR. This clears the point where the clock was due to reset to Sunday 00.00 and therefore puts the timer into the real time clock condition. A new reset time can now be entered if required.

Correction for mis-operation

Should an incorrect data entry be made, it is possible to re-write the data before pressing CLOCK, PERIOD, RESET, ON or OF.

Clock setting error

Entry of a clock setting greater than 23.59 will not allow the clock to run when the CLOCK button is pressed. Re-entry of a time less than 24.00 followed by CLOCK will start the unit running.

Memory time setting errors

The timer has provision for 28 ON and OFF times on a weekly basis and 4 on an everyday operation for each switch. If entry of more data is attempted the display will show 88.88 as an overload indication. To revert back to the clock display requires pressing CLEAR and then CLOCK. If a period of greater than 24 hours is entered using the PERIOD button, the display will show 88.88. It is then necessary to enter clear clock and re-enter the data within the given restraints.

Overlapping times

If any switch is instructed to turn ON and OFF at the same time, the following priority will take place:
(a) If the switch is already ON, then it will turn OFF.
(b) If the switch is already OFF, then it will turn ON.
Should any switch be operating in the period mode and an OFF time is programmed which conflicts with the period ON time, the OFF time will override the period mode, making the period shorter. However the period OFF time will still be present in the memory.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 267 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

PHILIPS G8 CHASSIS

The line output transformer had to be replaced, but the problem now is excessive width which cannot be reduced by adjustment of any of the controls.

This sort of thing in the G8 chassis is usually caused by failure of one half of the line output stage – this upsets the flyback tuning and reduces the e.h.t. Check both line output transistors for shorts or leakage, also if necessary the tuning capacitors wired across them (C5545/6). If the fault persists, check for punctures in the mica washers under the transistors, also the 1Ω base current stabilising resistors R5526 and R5528.

RANK A823AV CHASSIS

I'm having trouble with the a.f.c. in this set. As little information on this subject seems to have been published, I'd be grateful for any advice.

The a.f.c. action takes place in module AE on tuner panel Z513. Transistor 1VT5 takes the 39·5MHz i.f. signal and drives the discriminator transformer 1L14/15. The discriminator diodes 1D5/6 produce a positive-going output when the tuner drifts down band and vice versa. The voltage is fed via preset 1RV2 to pin 4 of the tuner – in series with the tuning voltage. If the alignment of 1L14/15 is correct, the first suspects are transistor 1VT5 and the diodes.

ITT VC200 CHASSIS

The symptom was a dead set. After some investigation we found that the set came back to life when the scan coils were disconnected – sound and e.h.t., but no scan of course. Unfortunately replacement scan coils have failed to cure the trouble – neither has replacement of the scan-correction capacitor and the various capacitors in the line output stage.

We've often had this symptom due to defective scan coils, but replacement has always restored correct operation. Make sure that your replacement yoke is of the correct type and correctly wired. If so, and the new coils aren't defective, the line output transformer would appear to be suspect.

SONY KV1810UB MkII

There's a multiple fault on this set. Mains fuse F601 has blown, the regulator and line output gate-controlled switches Q603 and Q510 have gone short-circuit, and the h.t. supply decoupler C548 on the timebase panel has splattered itself around the chassis. In view of the high cost of the gate-controlled switches, I'd appreciate advice on tackling the repair.

This is a difficult fault to deal with. The gate-controlled switches can unfortunately be ruined by a momentary interruption in their drive. The approach we adopt is to replace the two gate-controlled switches, the mains switch, transistors Q607/8/9 in the regulator control circuit, the sync/line/field oscillator i.c. (CX104A), the line drive coupling capacitor C538 (0·47μF electrolytic), the line flyback tuning capacitor C542 (1,800pF) plus C620 (4·7μF) and C624 (47μF) on the power supply panel, then carefully run up the set using a variac, with an external 19V supply applied to pin 17 of the power supply panel. If all is well, a small raster puts in an appearance with an input of about 100V a.c. Wash the panels with methylated or surgical spirit to remove all traces of electrolyte, and check the quality of the mica washers before replacing the two gate-controlled switches.

THORN 9600 CHASSIS

The picture jumps up and down from time to time. This continues for a few minutes, then the picture settles down again. The fault may not recur until the next day, and there doesn't seem to be any relationship between the occurrence of the fault and the length of time the set's been on. I've replaced the line and field oscillator panel PC890 and now suspect the field output stage.

It's unlikely that the field output stage could be responsible for this problem. Check the a.g.c. decouplers C141 (10μF) and C125 (47μF), and C830 (4·7μF) in the anti-breathing circuit. In case there's intermittent instability on the 34V or 24V lines, check if necessary zener diode W819 in the 24V regulator circuit, the 24V rail decoupler C803 (10μF) and the 34V supply reservoir capacitor C523 (470μF).

NATIONAL TC86G

There was a small click and the brightness disappeared, leaving the sound o.k. Turning up the brightness control made little difference – I could just see a very faint, slightly red picture. On switching the set off the e.h.t. collapsed as usual, then on switching back on again the picture returned. It worked o.k. for a couple of days, after which the same thing happened. All the supply rails seem to be correct, and a thorough check of the i.f./video board has failed to reveal anything amiss.

From past experience we would suggest that either the video emitter-follower transistor TR304 on the decoder panel is failing or that the 12V zener diode D355 on the tube base is faulty (it provides the supply for the low-light presets). If the c.r.t. first anode voltage (pin 10) falls when the fault is present, suspect R555 (120kΩ).

DECCA 30 CHASSIS

After an hour or two the picture fades out, leaving a blank screen. It takes about a minute for the picture to fade – the sound is not affected. If the set is switched off for a few minutes the picture returns and remains for a further hour or so.

The fault is probably due to a defect in the beam limiter circuit. The sensing point for the beam limiting action is the cathode of the line output valve. Check its cathode components R467 (6·8Ω) and C434 (100μF), and the beam-limiter smoothing capacitor C69 (50μF). If necessary, try replacing the PY500 and PL509 line output stage valves; also check the values of R444 and R453.

TEST CASE

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Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

It's a bad sign when a service department has regular customers – especially if the fault is the same one on the same piece of equipment. The offending set this time was rather a "golden oldie" so far as we are concerned – a Decca Model CS1910. This uses the original version of the famous Decca Bradford hybrid colour chassis, the particular specimen dating from about 1971. Out on rental, and with over ten years' solid revenue-earning history, we can hardly complain: it's done us proud, even though it's caused us some harassment of late.

The trouble started some months ago with a request for attention due to loss of the raster. There was very little sign of life in the line timebase, and the fuse (F2, 500mA) in the h.t. feed to the line output stage was found to have blown. On examination it was seen to have gone "gently" as it were, so the fault was put down to fuse fatigue and a new one was fitted. Some adjustment of the width, focus, convergence and grey scale produced a reasonable picture and the technician departed.

It was not many weeks before he was back! The symptoms were the same and the new fuse had failed softly like its predecessor. What to do this time? Resisting the temptation to uprate the fuse to 600mA, the technician confined himself to tapping the PL509 and PY500 line output stage valves with a screwdriver. There was no internal sparking visible, so another fuse of a different make was fitted and the technician went on his way again.

A few more weeks passed, the leaves fell from the trees, and off went the picture once more! Amidst anxious enquiries from the viewer about the course of events during the previous night's Dallas programme, in went a new PL519 and PY500, plus another fuse. That made a big difference: this time the fuse failed within a week!

The rather pale and washed out picture suggested that all was not well with the rest of the set. So our man earnestly exhorted the customer to change to a newer one. How much clearer J.R. would be on a brand new 22in. model! It was suggested that much of the mystery surrounding the doings of Sue-Ellen would be dispersed if the customer was to rent a sparkling new set. The interest thus kindled evaporated quickly enough however when it transpired that the rental for a new model would be half as much again as for the old Decca. Back into the van went the sales folder and price list: out came the service manual, oscilloscope and meter.

The set had had a chance to warm up during the sales talk bit, and the technician found that the line output stage valves were running much warmer than they should, with a hint of a red glow on the anode of the PL519. Excessive current was thus indicated, and confirmed by making an ammeter check at the h.t. supply fuseholder – the reading was about 500mA, depending on the beam current. Half an hour later the operation was over: the new fuse was passing about 280mA and the valves were running at their normal temperature. What small components were lying in the ash tray? Why was the picture now brighter and better contrasted? See next month for the answer and another test case item.

ANSWER TO TEST CASE 230
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Our problem last month concerned a Philips G9 chassis – with lack of width and brightness, low h.t., no sound and no solution that we could see! Coming back fresh to the job after lunch we first gave some thought to the fact that R3141 in the feed to the audio output stage was overheating. This resistor forms part of a decoupling network between the audio output stage and the source of its 45V supply, the emitter of the BU208 line output transistor. An idea dawned, and we coupled up an oscilloscope to see what was present at the BU208's emitter. What we saw was a whopping great 60V sawtooth, in fact the line output stage's current waveform.

Everything now fell into place. The emitter of the BU208 line output transistor is decoupled by a 2,200μF electrolytic (C5138) which also serves as the reservoir for the 45V supply. This electrolytic was virtually open-circuit, R3141 burning because of the excessive ripple current flowing to the associated downstream smoothing electrolytic (C3142, 47μF). The h.t. supply was low because the tips of the 60V waveform at the BU208's emitter were triggering the 51V zener diode D5134, which provides over-voltage protection, thus turning down the regulated power supply. A new capacitor, with a suitably high ripple current rating, restored everything to normal.

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